FLIGHT and The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

Managing Editor
G. GEOFFREY SMITH

Editor
C. M. POULSEN

Chief Photographer
JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

8-10, CORPORATION ST., COVENTRY. Telegrams: Autocar, Coventry. Telephone: Coventry 5210.

GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2. Telegrams: Autocross, Birmingham. Telephone: Midland 2971 (5 lines).

260, DEANSGATE, MANCHESTER, 3. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.

26B, RENFIELD ST., GLASGOW, C.2. Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Abroad: Year, £3 1 0. 6 months, £1 10 6. 3 months, 15s. 3d.
Registered at the G.P.O. as a Newspaper.

No. 1713. Vol. XL. OCTOBER 23rd, 1941. Thursdays, One Shilling.

The Outlook

Gas Bombs in China

THE Chinese assert that Japanese aircraft dropped gas bombs on Ichang, and that this was one of the reasons why the Chinese troops evacuated the city. The Japanese deny the allegation.

It is certainly worthy of note that, so far, gas has not been used by the Germans (or, of course, by the Allies) in this war. Likewise, it was not used during the Spanish civil war. This abstention is certainly not due to any humanitarian feelings on the part of the Germans, who were the first to make use of this foul weapon in April, 1915, during the second series of battles for Ypres. Gas is a difficult weapon to manage, especially in a war of rapid movement. It was not too manageable in the war of trench lines, for sometimes the wind turned and blew the stuff back on to the troops who had discharged it. It is a weapon which invites reprisals, and they can easily and quickly be put into operation. As the prevailing wind over Flanders is westerly, the Germans lost far more than they gained by introducing gas into the last war. Evidently they do not intend to bungle things in the same way this time.

These considerations do not mean that the Germans will not use gas when they think it will serve their purpose. One may surmise that they will keep it in reserve for use as part of a surprise attack, which they hope will finish the business and allow no opportunity for reprisals. If they attempt an invasion of this country we might expect a sudden use of gas which, they would hope, would paralyse critical sectors of our defences. They might well consider London, the seat of Government, as one of the most critical spots.

The Government continues to urge the public to have their gas masks always with them. To many citizens this seems unnecessary, but the authorities are wise to insist. Too many people are of a happy-go-lucky temperament, and will not take precautions until the danger is upon them. The only safeguard for such people is to induce them to acquire a habit of taking precautions, so that they will be ready for an emergency when it comes.

"The Boys in the Back Room" . . . .

ON more than one occasion, when discussing the ascendancy over German military aircraft established by our own, we have expressed a desire to be told the inside story of how the multi-gun armament of our fighters came to be discussed and decided upon. That wish has now been granted, and very appropriately at a time which marks the anniversary of the defeat of the *Luftwaffe* in the Battle of Britain last year. The Air Ministry has, at long last, deemed it wise to let the story be told, and it will be found elsewhere in this issue.

Flight has already traced the evolution of the present eight-gun fighters in detailed accounts of how they came into being at the Hawker and Supermarine works. The other side of the picture, the story of how the "customer" decided to order eight-gun fighters, reveals that it may all be said to have begun with an Air Ministry "minute" dated April 4th, 1933. That minute was signed by Wing Commander A. T. Williams. It did not visualise the monoplane fighter we know to-day, for the simple reason that the British aircraft industry had not at that time decided that the biplane would have to be supplanted. But the multi-gun idea was there; the biplane replacement of the Fury and Bulldog, at that

time our standard fighter types, was examined as a four-, six- and eight-gun machine. Actually the Gloster company had built and flown multi-gun fighters long before that, so there was nothing new in the idea itself. The biplane version contemplated in the Air Ministry minute did not show a sufficient improvement over existing types, and the project was not continued, but the eight-gun theme had taken root, and by the time Messrs. Camm and Mitchell had designed the Hurricane and Spitfire respectively, eight guns were a basic part of the design. The Air Ministry specification (it was known as the F36/34) was not issued until November, 1934, and by that time the design of the Hurricane was already well under way. As a consequence, Mr. Bulman, Hawker's chief test pilot, was able to fly the first Hurricane in the early autumn of 1935.

The first suggestion that preparatory work on production should be started before the prototype had been flown was made by Squadron Leader R. S. Sorley, who was at that time in the Directorate of Operations and Intelligence, under Air Marshal Sir Edgar R. Ludlow. Sqn. Ldr. Sorley, who is now an Air Vice-Marshal, and Assistant Chief of the Air Staff, did not quite get his way, but in this connection we may mention that Sir Frank Spriggs sanctioned the laying down of the plant for Hurricane production before the official Air Ministry order had been placed, and in that way saved many vital months, months which were probably of incalculable value in the Battle of Britain. Thus in all fairness it may be said that Air Vice-Marshal Sorley and Sir Frank share much of the merit of having got the Hurricane into production so quickly.

It does not, perhaps, appear much of a risk nowadays, when we have seen what the Hurricane and Spitfire can do, but to keep things in their proper perspective it is necessary to remember that monoplane experience was practically non-existent then, at least so far as military aircraft was concerned. It was often argued, and the argument was probably the strongest single factor in delaying for so long the adoption of the monoplane, that although it would certainly be much faster than the biplane it would not be sufficiently manœuvrable.

. . . . and Some Others

WHILE we applaud the Air Ministry's decision to give all possible credit for the eight-gun fighter policy to the two originators, Wing Commander Williams and Sqn. Ldr. Sorley, both of the Directorate of Operations and Intelligence, it seems to us that the picture is incomplete without reference to certain other officers who must have taken an important part in making that weighty decision which, it is not too much to say, saved the country last year. Quite without official blessing and, we fear, much against the personal wishes of those concerned, we therefore take it upon ourselves to recall certain facts which seem to us very relevant.

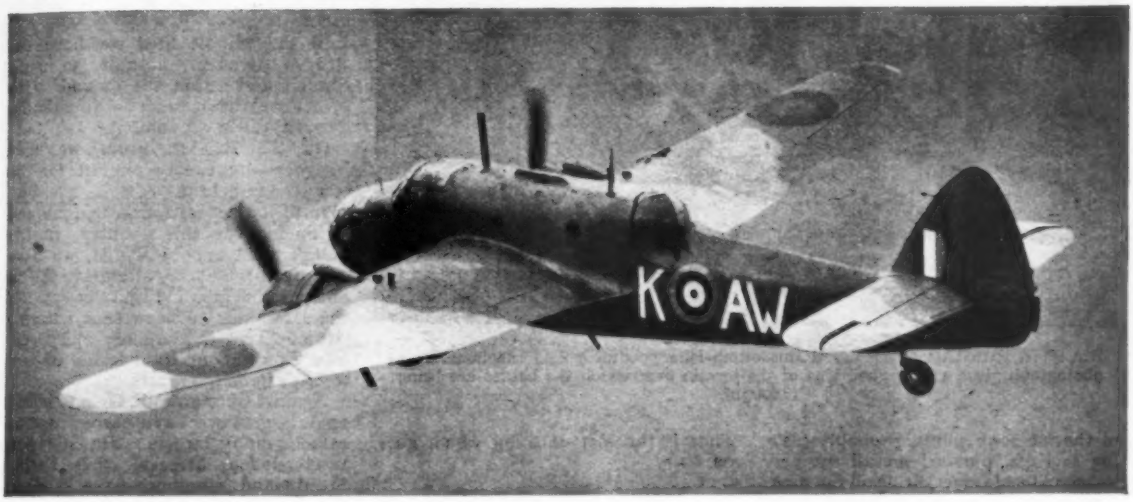
The Air Member for Supply and Research at that time was Air Marshal Sir Hugh Dowding, who had under him as Director of Technical Development Air Commodore H. M. Cave-Browne-Cave. The Deputy Director of Technical Development at that time was Major J. S. Buchanan, who is now Director-General of Aircraft Production.

In 1934 Fighting Area (the titles Fighter Command, Bomber Command, and Coastal Command had not then come into use) was under the command of Air Vice-Marshal Philip Joubert de la Ferté, who must obviously have put forward his views on the subject. It seems only fair that, in recording a nation's thanks to those whose foresight has meant so much to the country, we should not forget the men who at the time bore heavy departmental responsibilities.

THE SIGN OF THE WINGED SWORD: Students of the R.A.F. heraldry may recognise the squadron marking on the fin of this Bell Airacobra. This American single-seater fighter is credited with a maximum speed of 400 m.p.h. at operational height. An illustrated account of a visit to an Airacobra squadron will be found on pages 281—283.

War in the Air

Raid on Bavaria : Fighter Combats : Profit and Loss Account in September



OFF TO NORWAY'S FJORDS : A Bristol Beaufort of Coastal Command on its way across the North Sea to search for enemy shipping.

EVERY now and again the Bomber Command leaves the well-trodden (so to speak) paths which lead to the Ruhr, Hamburg and Bremen, and indulges in a long-distance raid. On a recent night Nurnberg in Bavaria was one of the targets, and that meant a flight, there and back, of over 1,100 miles for some of the heavy bomber squadrons. That night 300 bombers took off from various stations in Great Britain for Germany and occupied territory, but not all of them headed for Bavaria. Nurnberg is the second largest city in that country—kingdom it was up to the revolution in 1918—and there are many factories there. It is also a favourite spot for rallies of the Nazi party. The raid must have come as a shock to the inhabitants. It was very successful, and many factories were bombed.

STRIKING POWER : An underneath view of the Beaufort shown in the top photograph. The 18-inch torpedo is carried semi-submerged in the body of the machine. To keep the streamline form the bomb doors are closed on the sides of the torpedo.

The daylight raids by combined forces of Bomber and Fighter Commands continue, and in them the fighter pilots of our Allies, Dominions and the U.S.A. pull their full weight in the boat. Here is a story about two American pilots, members of an Eagle Squadron of the R.A.F.: The youngest member of the Eagle Squadron, who has now destroyed five enemy aircraft, was on the patrol with a comrade. On the way out of France he saw an Me 109 taking off, but before he got within range he saw another one behind it. He fired at this, but did not see any result as he swept overhead. His comrade, flying behind, had seen four others taking off, and shot at one of these. The two American pilots were towards the end of their patrol, and had not sufficient petrol to start a dog fight with opponents who had been freshly fuelled. They decided to leave well alone and return to base. They flew out, one at 50ft. and the other at 1,000ft. Several Me 109Fs dived on the Spitfires half-way across the Channel. "Two attacked my comrade," said the young Eagle pilot when he described his experience, "and four fastened on to me. One of the enemy aircraft on my tail opened fire, and I was flanked on both sides. I gave one a five-second burst with cannon and machine-gun. It shuddered violently, flicked on its back and dived into the sea. The enemy on my starboard side made a beam attack on me during this action and blew my hood off. I turned after him as he passed behind me and gave him all I'd got. Large pieces flew off him, and I turned for the English coast. But one

WAR IN THE AIR

R.A.F. IN RUSSIA : Wing Cdr. Ramsbottom-Isherwood at a field telephone. This photograph gives a very good idea of the terrain over which the battles are being fought.

of the Me 109F pilots, probably seeking revenge, pursued me all the way to the cliffs of Dover, firing all the time. I used all the evasive tactics I knew, but the enemy aircraft was flown by a very experienced pilot, who often regained his position on my tail. Even in that hectic chase, however, I had had time to see one thing that gave me a kick—another Me 109 go into the sea, shot down by my comrade."

That is the sort of thing which goes on daily

September Records

THE following information is compiled from official communiqués, and sums up our doings in the air during the month of September.

In carrying out all offensive operations over Germany and occupied territory and in the defence of this country, the Royal Air Force have destroyed a total of 134 enemy aircraft, of which 119 have been destroyed by day and 15 by night. In the course of our operations, including daylight sweeps over enemy-occupied territory, we have lost a total of 173 aircraft, 90 of which have been by day and 83 by night.

In the Middle East we have destroyed 50 enemy aircraft, 30 in air combat and 20 on the ground. Our own losses have been 30 aircraft destroyed, all in air combat.

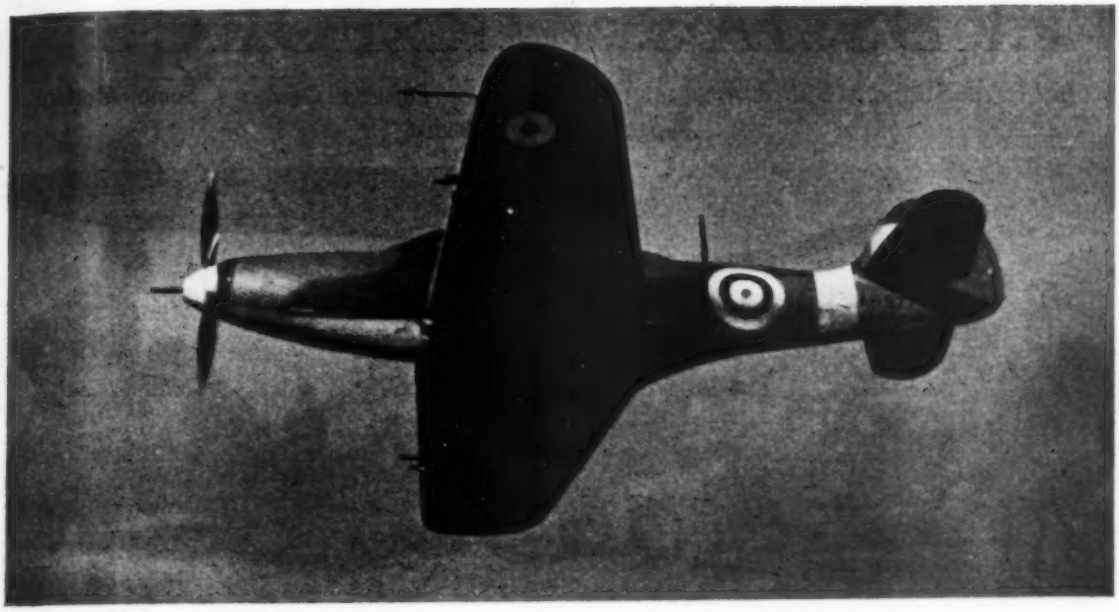
On the Russian Front we have destroyed 12 enemy aircraft for the loss of one fighter.

In all our operations, offensive and in defence of this country, in the Middle East and in Russia, we have destroyed 196 enemy aircraft in the air and on the ground; and, in spite of the fact that we have been carrying the offensive to Germany and Occupied France, our total losses amount to 204 aircraft.

Against German military and industrial targets we have carried out 28 attacks on 15 targets. Frankfort has received four attacks, while Berlin, Stettin and Hamburg have received three each. The outstanding attack during the month was made against Berlin on the night of September 7th-8th.

In occupied territory we have carried out 47 attacks against 26 military targets. Ports and docks have received most attention, Le Havre and

DOWN AT TOBRUK : A Messerschmitt 110 which will not bother our troops any more. It appears as if the souvenir hunters have already been busy. Who won the watch ?



THE SNAKE IN THE AIR : Bell Airacobras are arriving in quantity and are in operational service with the R.A.F. Armament consists of a cannon firing through the airscrew hub, two machine guns in the body and four machine guns in the wings.

ENEMY AIR LOSSES TO OCT. 18th.

	Over G.B.	Over Continent.	Middle East
Oct. 12	2	0	4
,, 13	0	20	1
,, 14	0	1	1
,, 15	0	5	0
,, 16	1	1	0
,, 17	0	0	1
,, 18	0	0	0
	3	27	7

Totals : North and Russia, 5,480 ; Middle East, over 2,138.

Cherbourg having been attacked on six occasions; while St. Nazaire and Boulogne have been visited four and three times respectively.

In the Middle East 120 attacks have been carried out against 39 ports, aerodromes and military targets. The greatest number of attacks have been directed against Benghazi and Tripoli, 12 having been made against the former and 11 against the latter.

The R.A.F. have made three attacks on Italian targets, two against Turin and the other against Genoa.

In all bombing attacks on all fronts the R.A.F. have made 198 attacks against 82 Axis targets during the month of September.

BRITISH AIR LOSSES TO OCT. 18th.

	Over G.B.	Over Continent			Middle East
	A'crft	B'brs.	Ftrs.	Pilots	A'crft.
Oct. 12	0	11	0	0	4
,, 13	0	6	12	10	0
,, 14	0	5	0	0	1
,, 15	0	10	1	1	0
,, 16	0	3	1	1	0
,, 17	0	0	0	0	0
,, 18	0	0	0	0	0
	0	35	14	12	5

Totals : North and Russia, 2 873 ; Middle East about 433.

Since the first attack by the American Fortresses, which took place on July 24th against Brest, 12 attacks have been made from great height. Seven of these attacks were made on German towns, of which three were against Emden.

In the North Sea and off the Atlantic coast the Royal Air Force have sunk or damaged 53 enemy ships, while in the Mediterranean a further 48 have been sunk or damaged, a total of 101 ships, or approximately 3½ ships per day. A new feature of the attacks on shipping has been the use of the four-cannon and 12 machine-gun Hurricanes, which have succeeded in setting on fire or sinking 12 enemy vessels.

The Russian garrison has been evacuated from Odessa by sea, and as we go to press Moscow is still stoutly defended by the armies of Marshal Timoshenko. The Russians report that their Air Force is extremely active in bringing down enemy aircraft, bombing others on the ground, and attacking the tanks, armoured cars, and lorries of the Germans. The Russian pilots are certainly gallant men. No recent news has come from the R.A.F. Wing in Russia.

CANNON ATTACK : An enlarged photograph from a 16 mm. cine-film of an attack on a German *Flak* ship by a four-cannon Hurricane II. The cine-camera was in the leading edge of the Hurricane and operated by the gun trigger.

RUSSIA'S AIR FORCE

Its Total Strength Still Uncertain : Influence of Foreign Design : Some Modern Types Now in Service

An I-15 single-seater fighter on a Soviet aerodrome. Note the Hucks type mobile starter and the pilot's Irving type parachute.

ONE of the major mysteries of the present war is undoubtedly the Red Air Force and its machines. No doubt Lord Beaverbrook and Mr. Harriman are, since their Kremlin conference, in possession of salient facts which it is not considered wise to make known at present for obvious reasons, but the world at large knows very little more than the statisticians, whose varying estimates during the past few years must surely have been too modest; the Soviet airmen's splendid performance during the conflict with the Germans strongly indicates as much.

Equally as important as the actual numbers is the question of aircraft types now being used by the Russians, and here again scant information is available. But it certainly seems more than probable that they are more technically advanced than was generally supposed.

One item of information which supports the view that Soviet airmen are using up-to-date types about which they have preserved a discreet silence is that six new fighter and bomber types were demonstrated at a big parade in August of last year, about which no details have yet been released, though it seems safe to assume that the Stormovik, mentioned by Lord Beaverbrook and illustrated here, is one of them.

That gigantic strides were made in Soviet military aviation between 1934 and the outbreak of the present war is common knowledge. An authoritative statement on the position was, in fact, made by Marshal K. Voroshilov, People's Commisar of Defence of the U.S.S.R., when he spoke at the 18th Congress of the C.P.S.U. in 1939, and this was reported fully in an account of the conference speeches issued by the Foreign Languages Publishing House, Moscow. Some of the Marshal's figures were given in *Flight* of July 3rd, in a previous article on Russia's air strength, and at the risk of repetition it will be instructive to include further extracts here.

A la HURRICANE : This is the I-26 single-seater fighter, the clean up-to-date lines of which are strongly reminiscent of our own Hurricane. It is believed to be the newest type of Russian fighter and in use against the Luftwaffe.

Big Increases

Reviewing the growth of the Red Air Force during the previous five years, Marshal Voroshilov said that its personnel had increased by 138 per cent., and the total number of aircraft by 130 per cent. That considerable progress had been made in design as well as numbers was shown by his further statement that if their strength were calculated by horse-power, then the increase was 213 per cent., or 7,900,000 h.p.

Further figures showed that the major portion of the numerical increase in air strength had been in heavy bombers, which had been doubled, and in "pursuit planes" (fighters) whose proportion of the total had risen from 12.3 per cent. to 30 per cent. These increases, however, were at the expense of light bombers and battle planes, whose proportion to the total was halved.

An interesting table on the percentage increase in the performance of the various types was also given as follows:—

	Speed	Ceiling	Range
Pursuit planes -	56.5	21.5	—
Bombers (long range)	70.0	77.0	61.0
Bombers (short range)	88.0	83.0	50.0
Scout and battle planes	67.0	23.0	45.0

Mention was also made of machine-gun fire power four times as great, and bombers capable of more than 300 m.p.h. It will not have escaped the reader's notice, however, that the discreet Marshal spoke almost entirely in percentages, leaving it to foreign journals to speculate on actual numbers of aircraft and production facilities.

Fifty Air Divisions?

It is probable that figures from an Italian source quoted by *Inter Avia* of July 15th this year are nearer the mark than earlier French and German estimates. This gives the Red Air Force as comprising, at the outbreak of hostilities, 50 Air Divisions ready for service with a total of 15,000 first-line aircraft, of which 30 per cent. were held in reserve. The proportion of types is stated to be 45 per cent. bombers (heavy and light), 40 per cent. fighters, and 15 per cent. reconnaissance and naval types.

The constitution of the Red Air Force is, of course, very different from our own. Before the war (there may have been necessary changes since) it was divided into two sections, the Western Air Force (European), which accounted for two-thirds of the total strength, and the Eastern Air Force, which was based in Asia and the Far East. Each Air Division was divided into three to five Regiments, which in turn were split up into groups and squadrons varying in numbers according to requirements. And each squadron, or "Atriad," consisted of 12 to 15 fighters or 6 to 10 bombers.

Naval air units (presumably included in the 50 Air Divisions) were differently organised. They were divided into brigades, groups and squadrons which varied in their numerical composition in the four different Naval Commands—namely, the Baltic, Arctic, Black Sea and Pacific commands. These naval air units were equipped with about 500 aircraft and three aircraft carriers of from 10,000 to 15,000 tons.

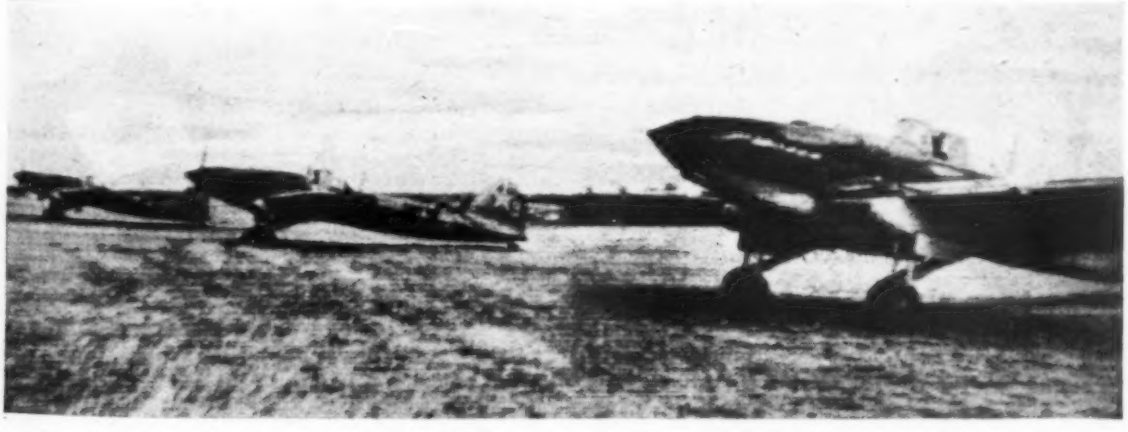
Additionally there were some dozens of Parachute Battalions and at least one Division of air-borne infantry.

PLAN OF ACTION. Here are some Russian Air Force officers apparently in conference. The excellent quality of their uniforms and such equipment as binoculars and map cases is evident from this picture.

Political Influence

As regards the aircraft themselves, it must be remembered that the development of their industry, during the past ten years or so, has been influenced by varying political circumstances. In the first place, the Treaty of Versailles, which prevented German firms building in their own country, drove Junkers, Heinkel and Dornier to Russia, together with their staffs of engineers and tooling equipment, and made a decisive contribution to the first plants of the Russian aircraft industry. It is not surprising, therefore, that until recently Russian bombers showed definite resemblance to Junkers all-metal designs.

Up to 1937 their own leading designer was Tupoleff, but he seems to have shown an unhealthy interest in things German other than Junkers aircraft, with the result that he was duly "purged." Since then, such men as Polmovsky and Polikarpoff have been responsible for many improvements and refinements in Russian aircraft, but there is no actual proof that any of their own designs are yet in production. Even as recently as the Finnish war in 1939, the chief Soviet bomber was a Martin design built under licence. Most of the Russian



RUSSIAN DIVE BOMBERS: Three Stormoviks taking off from a forward aerodrome. The Stormovik is one of the new types mentioned by Lord Beaverbrook.

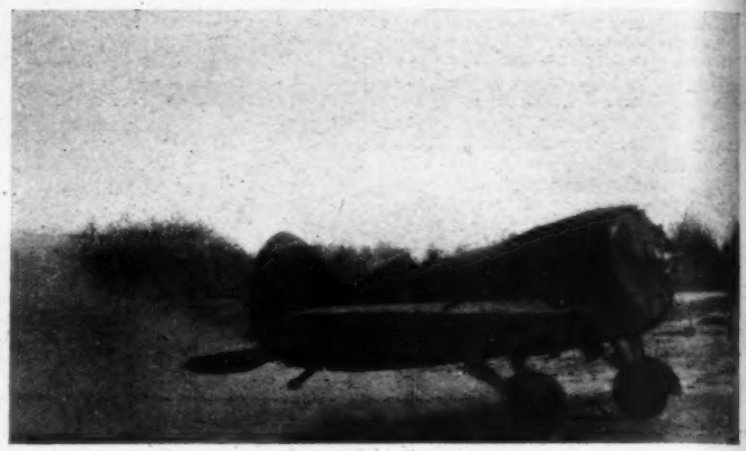
RUSSIA'S AIR FORCE

'planes, in fact, were either German, American or French designs built under licence, or their own layouts, largely inspired by such aircraft. The same also applies to their aero engines. The M-34 liquid-cooled engine, for example, was a crossbreed of the Liberty, Hispano-Suiza and Rolls-Royce. Russia also bought the manufacturing rights for the liquid-cooled B.M.W., the Hispano-Suiza 12Y, the Wright Cyclone and the Gnome et Rhone air-cooled types.

Of the machines in use with the Soviet air force to-day, probably the very latest type of fighter is the I-26, a photograph of which appears on p. 274. No precise details are obtainable at the moment, but it is probably fitted with the latest edition of the M-100 engine which is the Russian version of the Hispano-Suiza 12Y liquid-cooled engine of 850 h.p. Another quite modern-looking fighter is the I-16 (see p. 275), which has an American inspiration and is powered by the M25, a nine-cylinder radial modelled on the Cyclone. This fighter is credited with a speed of 285 m.p.h. and a ceiling of 31,500ft.

The "I" Series of Fighters

Although a big proportion of them are probably replaced by later monoplane types by now, Russia probably started her present conflict with a great number of I-15 single-seater biplane fighters (p. 274), which certainly owe something to the French Breguet. This compact little machine has hummed across the screen during many a recent newsreel! The "I" series of Russian fighters, however, seems to have gone all Hurricane as from No. 17 onwards, as a glance at the picture of the I-26 will show. The I-17 was the first of this type and had the M-100 engine, while its successor, the I-18, was described in an American journal a few months ago as "influenced by British design and the best they've got." Another similar machine is the Z.K.B.-19, for which 300 m.p.h. is claimed.



AMERICAN INSPIRATION. The tubby fuselage of this I-16 with its radial engine strongly features the American Gee-Bee monoplane of several years ago. The pilot, it will be noticed, sits well back.

The position as regards bombers is rather more obscure. One of their latest heavy types is the TB-6 fitted with four Russian-designed engines (M-34 liquid-cooled of 950 h.p.) which are supplied with compressed air by a M-100 engine in the fuselage—an unusual form of supercharging. Constant-speed airscrews and flaps are employed and the performance figures are given as, speed 280 m.p.h., ceiling 26,000ft., loaded weight 51,700 lb., and range with 4,410 lb. bomb-load, 1,250 miles.

Another heavy bomber is the ZKB-26, which is the Russian version of the Martin 139, and is fitted with either M-100, 750 h.p. Cyclones or 1,000 h.p. M-85 radials, the last-named being Russian-built 14-cylinder twin-row Gnome et Rhone 14K engines. A maximum bomb-load of 2,200 lb. is quoted for this aircraft, together with a speed of 261 m.p.h., a ceiling of 24,600ft. and a range of 950 miles.

Dive Bombers

Dive-bombers are a comparatively recent Russian development the newest being the Stormovik (more or less *à la* Fairey Battle) and the twin-engined Baumuster P-2 or BB-22.

Russian flying boats and float-planes are, so far as is known, limited to foreign types built under licence. These are principally Dornier Wal and Savoia-Machetti S-55 and S-62 types. In 1937, however, they bought a Consolidated flying-boat and a licence to build this type, which is believed to be now in production.

FORCED LANDING. This is the only picture so far to reach this country of a Baumuster P-2 (or BB-22) dive-bomber. In outline it resembles the Me 110, but its function is the same as that of a Ju 88.

★ *The above picture shows G.A.L. Rivet Clamps holding a metal skin in position. Maybe there is a use in your works for this important contribution to faster production.*

★

SNAPPED into place with one hand, simply and quickly.

★

G.A.L. Rivet Clamps grip stressed skins firmly in position during riveting.

★

No slipping, no scratching, no detachable parts.

★

Large quantities of G.A.L. Rivet Clamps available for immediate delivery.

OVER 1,000,000 IN USE

G.A.L RIVET CLAMPS

H 51

GENERAL AIRCRAFT LIMITED *Enquiries to* Sales Dept., London Air Park, Feltham, Middlesex.

Overseas enquiries to our Export Division:- ENGINEERING & AVIATION EXPORTS LIMITED, 50, PALL MALL, LONDON, S.W.1

Telephone: Abbey 6210

AIR GUNNERS IN TRAINING

Much Ground Work to be Done Before a Gunner Fires His First Round in the Air

FREQUENTLY the lives of a whole air crew depend on the cool head and good shooting of an air gunner in his power-operated gun turret. In like manner to the training of the other members of our air crews, the Royal Air Force sets a very high standard in the belief that only gunners of the very highest quality can perform the work that is expected of them.

Continual dismantling and assembly of the guns they will use in the air ensures a familiarity with the mechanism which in time of need becomes automatic. Another point of special interest is the use of standard air helmets and the telephonic communication between instructor and his class. This to a large extent simulates the conditions prevailing when using the intercommunication system on an aircraft.

(*Top, left*) Learning how to estimate range and identify aircraft. Photographs of enemy aircraft are used for this. The size of the image corresponds to that of the real machine at a given distance. (*Centre, upper*) Using hand-held reflector sights to judge the speed of a target aircraft. (*Centre, lower*) Sergeant gunners dismantling and re-erecting .303in. Browning machine guns. (*Bottom*) A portable rear turret—powered in the same manner as those on aircraft—is used to familiarise gunners with the mechanism and the controls. (*Top, right*) The real thing. A fully trained air gunner in the rear turret of a Welllington.

Ninth of the Series

FRIEND or FOE?

Four-engined Rivals with Twin Tails

HANDLEY-PAGE HALIFAX. Gun turret in tail; rudders divided by fixed tailplane tips; vertical surfaces outrigged. Fixed tail-wheel.

IN recent utterances, in print and on the radio, a number of eminent gentlemen have reminded us—though probably we didn't need it—that should the Germans succeed in their Russian objective before the real winter sets in, then an attempted invasion of this country next spring will be a foregone conclusion.

Be that as it may, however, it is certainly pretty safe to assume that, if and when the invasion of this country is attempted, air-borne troops will play a big part, and enemy troop-carriers of types perhaps not previously seen over these shores may well be pressed into service. It will be just as well, therefore, if we can identify them before they deposit their hostile occupants, especially when, as exemplified by the illustrations on this page, they resemble some current British type.

Similarity

The similarity between the Halifax and the Junkers Ju 90 troop transport is particularly marked from this angle. One gets the full benefit of the short outboard engine nacelles and the long inner pair with the retracted wheels protruding, and at the same time the violent backsweep on the leading-edge of the Junkers' wing is minimised, while the shape of the nose is almost entirely hidden.

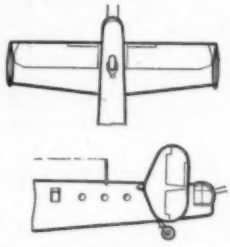
Their respective tail groups are also very much alike, but the one important and obvious difference is provided by the rear turret of the British bomber. The "chisel" extremity of the Ju fuselage boasts no sting.

Both tailplanes taper slightly (the Halifax on the leading-edge only), and are set in approximately the same position in relation to the fuselage. But the mounting of the fins and rudders provides an exception to the usual national characteristic in that, this time, it is the German machine, not the British, on which the tailplane tips project outside the vertical surfaces. Notice, too, that the projecting tip is streamlined off by a piece of fairing attached to the outer surface of the rudder, which also has a horn balance. The rudder surfaces of the Halifax are also unusual in that each one is divided by the flush-fitting tailplane tip, the elevators being "inset" portions of the fixed horizontal structure. In the case of the Ju 90, however, the fixed tailplane and the fixed fins have the same chord where they intersect, the elevators being projecting surfaces shelved off at the outer corners to permit rudder movement.

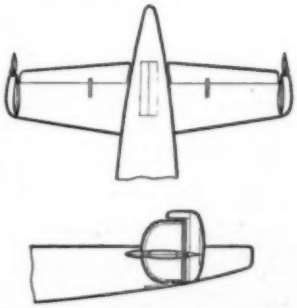
Another little difference worth noting is that the Junkers' tail wheel completely retracts within the fuselage, whereas that of the Halifax does not.

Next week: Bristol Beaufighter and Focke-Wulf Fw 187.

HALIFAX I



JUNKERS Ju 90



JUNKERS Ju 90. Chisel-shaped tail to fuselage; tailplane tips project beyond fixed fins and streamlined by fairings on rudders, which have horn balances. Elevators have mass balances. Fully retractable tail-wheel.

STIRLING SQUADRON

The crew of a Short Stirling about to board their machine while another Stirling in the background taxies to the take-off point

A Visit to One of Our Oldest Squadrons Which is Operating One of the Newest Bomber Types

Illustrated by "Flight" Photographs

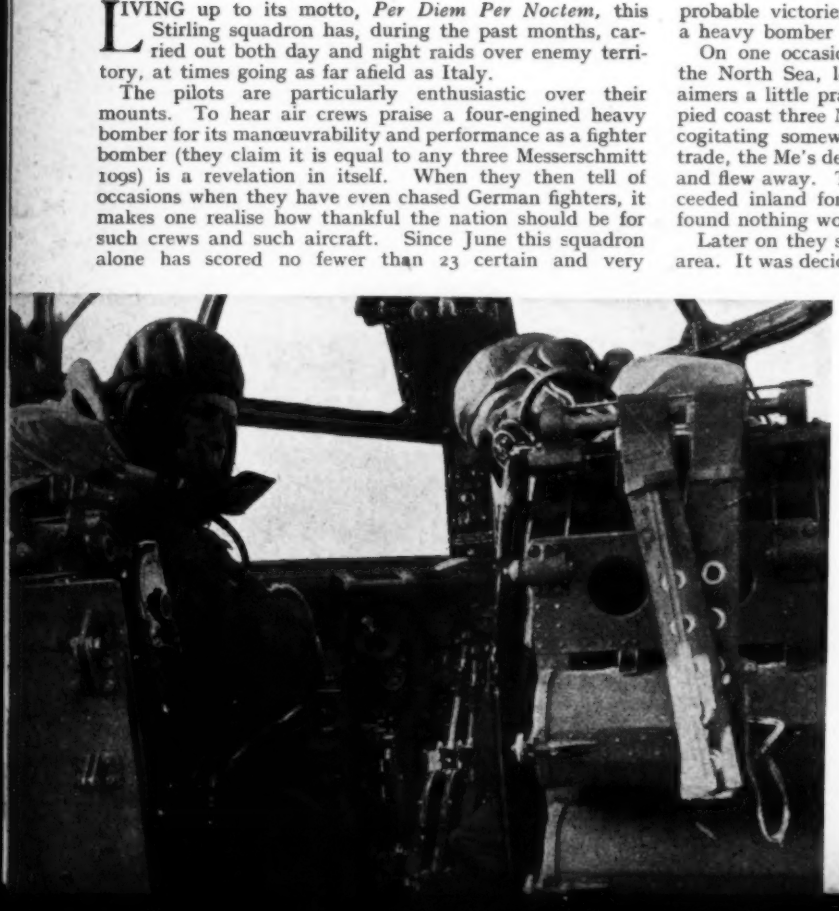
LIVING up to its motto, *Per Diem Per Noctem*, this Stirling squadron has, during the past months, carried out both day and night raids over enemy territory, at times going as far afield as Italy.

The pilots are particularly enthusiastic over their mounts. To hear air crews praise a four-engined heavy bomber for its manœuvrability and performance as a fighter bomber (they claim it is equal to any three Messerschmitt 109s) is a revelation in itself. When they then tell of occasions when they have even chased German fighters, it makes one realise how thankful the nation should be for such crews and such aircraft. Since June this squadron alone has scored no fewer than 23 certain and very probable victories over the *Luftwaffe*—not bad going for a heavy bomber unit.

On one occasion, in daylight, two of them went over the North Sea, looking for something to give the bomb-aimers a little practice. At 3,000ft. over the enemy-occupied coast three Me 109s came up for an interview. After cogitating somewhat on the possibilities of doing some trade, the Me's decided the game to be not worth the candle and flew away. The two Stirlings—fully bombed up—proceeded inland for some miles to have a look round, but found nothing worthy of attention.

Later on they spotted an enemy convoy in the Dunkirk area. It was decided to make an attack in line-astern, but, unfortunately, the two machines got separated in a patch of cloud. Immediately the leading machine had dropped its bombs they were attacked by six Me 109s. Since it is obvious that an empty machine is much more agile than one which still has its bomb load aboard, the leader did his utmost to draw the Me's away while the second machine made its bombing run up. Three machines were drawn off in this way, and they made their attacks from the port and starboard quarters and from directly astern.

Attacker number one fired a badly aimed burst and received attention from the Stirling's four-gun rear turret as he came past to overshoot and come up on the port bow. Not to be outdone, the Stirling dived after this fighter, and by getting the A.S.I.



The captain and second pilot at the controls. The "office" of the Stirling is well lighted and all the multiplicity of controls come nicely to hand.

On the navigator-bomb-aimer depends very largely the success or otherwise of the trip. A chart table of ample size and well lighted is an essential feature.

up to the 400 m.p.h. mark kept the front gunner within range. This front gunner was on his first operational flight, and it is not surprising that his first two bursts had insufficient deflection allowance. However, treating these as sighters, he pumped three more good bursts right into the Me, which threw out a cloud of smoke and went down straight into the sea.

Me No. 2 then made his attack. For his trouble he received a hefty burst from the rear turret, and it is extremely doubtful if he ever reached home again. Messerschmitt No. 3 did make the Stirling's crew wonder for a while. He came down in an almost vertical dive, and there was considerable apprehension as to whether the Stirling would be rammed. At the last moment the Me pilot must have remembered that he did not belong to one of the Axis' suicide squadrons—of which we used to hear so much and have seen so little—that he sheered off and returned home.

Night Attack

While this scrap was going on the other Stirling made its bombing run, with the remaining three German fighters closing in to attack. After dropping its load this Stirling also dived at 400 m.p.h. right down to sea level, and, before the enemy gave up the attack, shot one of the 109s down in flames. Altogether a very profitable trip!

The Wing Commander who commands the squadron also tells a good story in praise of his machine and crew during a night raid over Germany. It must be mentioned in passing that the Wing Commander's rear gunner is a man of 42 who has, as he says, "made guns his hobby." According to the C.O. he has a collection which amounts almost to a private arsenal.

On this particular night and target the ground defences were, to say the least, exceedingly active. Caught in a concentration of at least 30 searchlights, the Stirling was hit three times by A.A. shells. The third hit produced a terrific draught in the fuselage, and the bomb-aimer's voice came over the inter-communication telephone saying, "That's fine, clear-vision shooting to-night, sir." (He meant that the bomb-aiming panel of optically flat glass had been shattered in front of him.)

Over Borkum

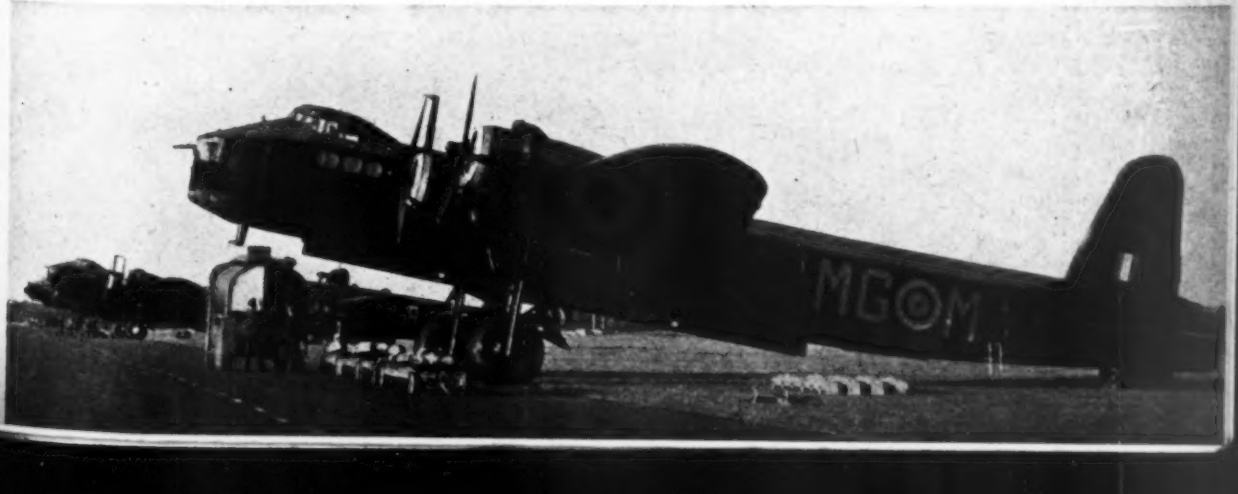
Eventually the Stirling got out of the *Flak* area, and almost at once came a wistful voice from the tail turret, "You've had all the fun up to now. What about finding something for me to shoot at."

Despite the damage they had received, the Wing Commander decided to return by the direct route which would take them over Borkum. This is known to be a hornets' nest of night-fighting Messerschmitt Me 110s and, sure enough, up came one to make contact with the Stirling. For a while the two machines waltzed around, each trying to get the other up-moon. The Stirling proved to be quite able to look after itself at this game.

For a time it was thought that touch with the enemy had been lost, until a long burst of some 700 rounds was fired. Then, from the rear turret, came the laconic remark, "That's finished that—anyway." The Messerschmitt could be seen going down in flames. Apparently the gentleman in the back end who "made guns his hobby" had waited until the "110" was well within a hundred yards before he gave one long burst of fire.

These are just two examples—one by day and another by night—of the courage and skill with which these air crews work in their Stirlings. The stories are told in a quiet voice with no trace of bombast or vainglory. Their eyes light up with a smile when they tell of the humour of some desperate situation. It is somewhat of a tragedy that we have come to take such heroism for granted.

Although only night operations may be in hand, the aerodrome is busy throughout the whole 24 hours. During the morning details about the target, bomb load and the number of machines required come through from Bomber Command. Then a meeting is held between the control officer, the meteorological officer, and the navigation officer to decide the time-table and the route. The time-table is most important, because it would be fatal to have a dozen



A line of three Short Stirlings being bombed-up and refuelled ready for the night's raid. The length of the bomb bay and the high aspect ratio of the fin and rudder are accentuated in this photograph. The entrance and ladder are just aft of the squadron letter.

ESA

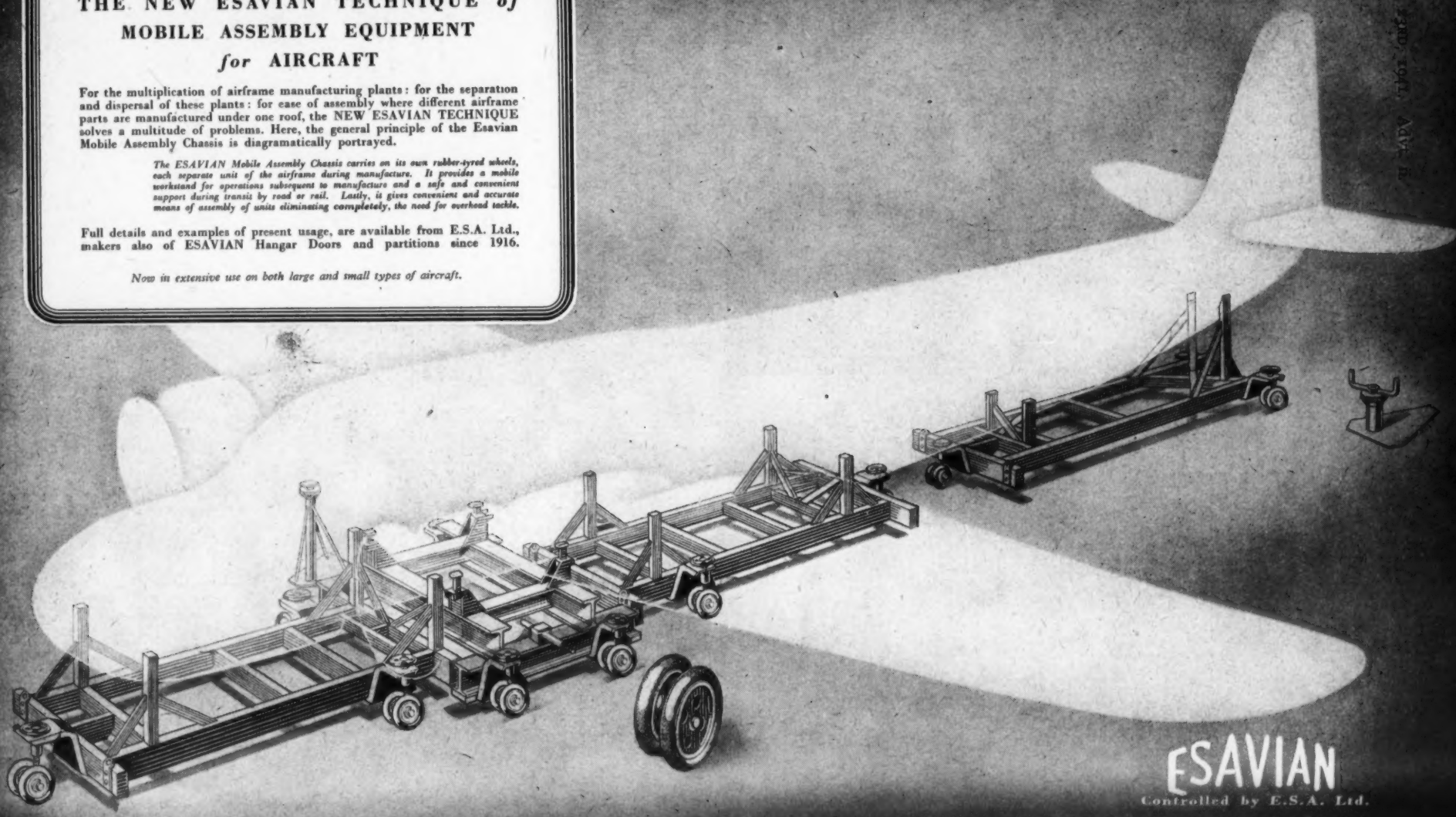
THE NEW ESAVIAN TECHNIQUE *of* MOBILE ASSEMBLY EQUIPMENT *for* AIRCRAFT

For the multiplication of airframe manufacturing plants: for the separation and dispersal of these plants: for ease of assembly where different airframe parts are manufactured under one roof, the NEW ESAVIAN TECHNIQUE solves a multitude of problems. Here, the general principle of the Esavian Mobile Assembly Chassis is diagramatically portrayed.

The ESAVIAN Mobile Assembly Chassis carries on its own rubber-tyred wheels, each separate unit of the airframe during manufacture. It provides a mobile workstand for operations subsequent to manufacture and a safe and convenient support during transit by road or rail. Lastly, it gives convenient and accurate means of assembly of units eliminating completely, the need for overhead tackle.

Full details and examples of present usage, are available from E.S.A. Ltd., makers also of ESAVIAN Hangar Doors and partitions since 1916.

Now in extensive use on both large and small types of aircraft.



ESAVIAN

Controlled by E.S.A. Ltd.

HEAD OFFICE: 183 HIGH HOLBORN LONDON W.C.1

FLIGHT, Oct. 23rd, 1941. Adv. 81

STIRLING SQUADRON

The Short Stirling is so well proportioned that it does not usually appear to be a large aeroplane. The two figures in this three-quarter rear view help to show how big it really is.

(Left) Most important of all: the bomb aimer's position in the nose under the front gun turret. On the right-hand side can be seen the bomb selector switches.

machines all returning at once and unable to land owing to congestion.

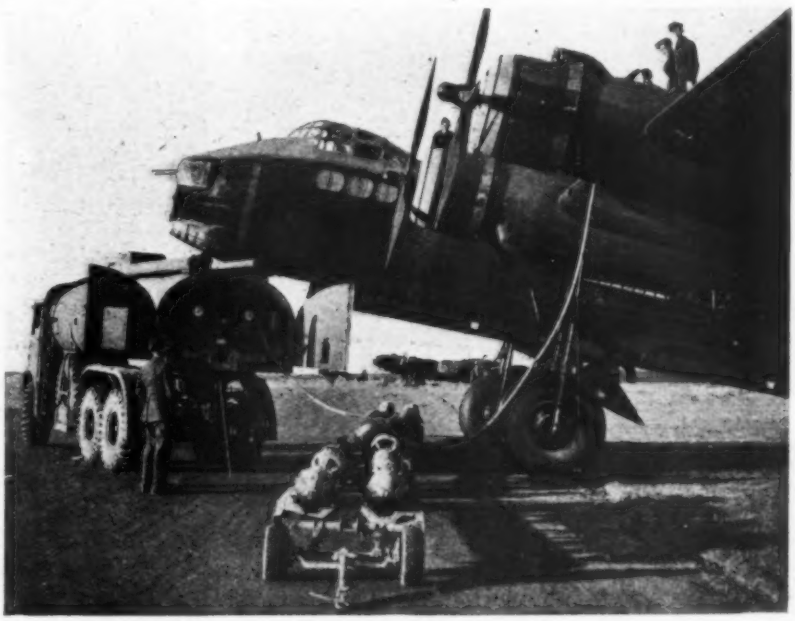
Later on the crews are briefed, and all take their machines into the air to make sure everything—both aeronautical and military—functions smoothly. After this they are refuelled and bombed-up for the job in hand and remain at the dispersal points until required.

Faced with the problem of long hauls to targets in Germany and Italy, these four-engined bombers, which are now going into service in considerable numbers, are proving economical in both air and ground crews. One Stirling, for instance, is equal in bomb load to three or four Wellingtons or nine Blenheims, but neither the ground crews nor the air crews are even twice as large. In speed there is also a direct gain; the most economical speed of the Stirling is in the neighbourhood of 200 m.p.h.

Obviously the Air Ministry are not making the enemy a present of all the details of the Stirling, but a certain amount of information is allowed for publication. Span is 99ft.; length, 87ft. 3in.; and height, 22ft. 9in. Despite these measurements the machine is so well proportioned that the Stirling does not appear to be a particularly large aeroplane. This illusion is also manifested when speed is being estimated. The Stirling makes its approach at round about the 100 m.p.h. mark, but *appears* to land slower than a Wellington which, of course, actually touches down many miles an hour slower.

Engine Arrangement

The monoplane wing is mounted mid-way in the depth of the fuselage and is tapered in plan form, typical of the Short wings employed on the Empire and Sunderland boats. Four Bristol Hercules 14-cylinder sleeve-valve engine of 1,400 h.p. each are usually fitted, but some Stirlings have double-row Wright Cyclones. The outer engines are mounted equally above and below the wing profile, but the inner pair are set lower in order to provide sufficient room for the undercarriage to retract into their nacelles. The tyre still projects slightly when in the

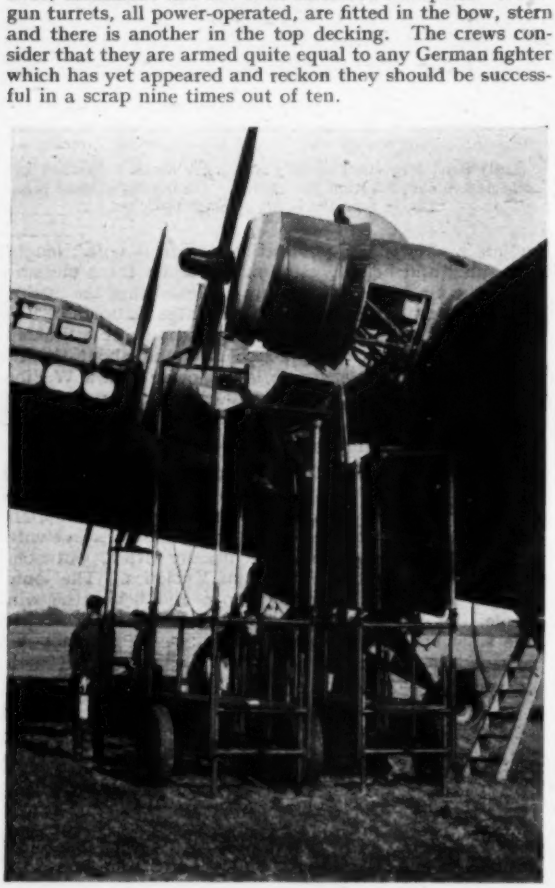


At the same time as bombing-up takes place, petrol lorries fill the Stirling's tanks.

STIRLING SQUADRON

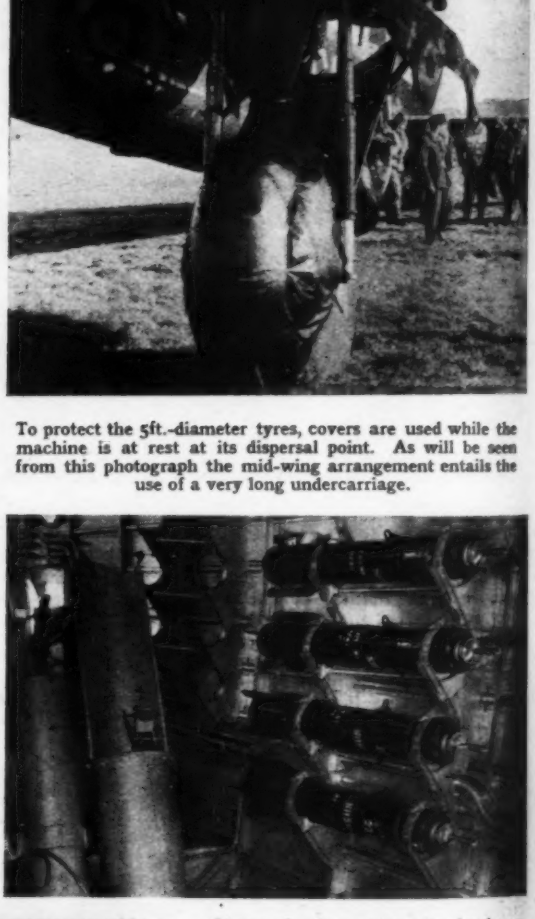
fully retracted position. Twin tail wheels—also retractable—are fitted to take care of the tail loads when landing.

A particular feature of the machine is its roominess. The almost rectangular-section fuselage allows absolute freedom of movement, except where the main spar passes through the body. The bomb bays can only be described as tremendous, extending as they do for more than 40ft. in length and over the full width of the fuselage. A 2,000 lb. bomb in these racks loses all sense of enormity, and 500 lb. G.P. bombs are positively dwarfed. Despite the efforts which have been made to crowd on every possible mile per hour, armament has not been sacrificed for speed. Multi-gun turrets, all power-operated, are fitted in the bow, stern and there is another in the top decking. The crews consider that they are armed quite equal to any German fighter which has yet appeared and reckon they should be successful in a scrap nine times out of ten.



To attend to the needs of the Bristol Hercules engines and their D.H. hydromatic airscrews special gantries have been devised for the use of the engine fitters.

To protect the 5ft.-diameter tyres, covers are used while the machine is at rest at its dispersal point. As will be seen from this photograph the mid-wing arrangement entails the use of a very long undercarriage.



(Above) In the rectangular fuselage of the Stirling such things as flare containers and flare chutes can be comfortably spaced.

(Left) Twin wheels are necessary to take the tail loads of the Stirling. They are completely retractable and in this photograph are shown at right angles to the fuselage.

UNTO CÆSAR

History of the Official Birth of the 8-Gun Fighter : How Hurricane and Spitfire Came to be Adopted

AT a time which marks the anniversary of the defeat and final rout of the *Luftwaffe* in their major daylight attacks upon England of last year, it is fitting that we should remember how much we owe to the Hurricane and Spitfire and the men who designed them, and those who worked for the incorporation of these aircraft in the Royal Air Force.

The decisions which come to affect the balance between two air powers are taken long before the opposing aircraft exchange fire. The tactics of air fighting to-day are vastly influenced by the designing board of yesterday. It was certainly this aspect of air warfare which was most strikingly emphasised in the Battle of Britain.

The fact that we possessed at such a crucial moment a fighter of such performance that small numbers were able to establish superiority over anything the enemy could send over is a grand tribute to the men who foresaw in the developments of modern bombers the need for a fighter of superlative quality as a defensive weapon.

It is as well to establish a picture of what would have happened had the *Luftwaffe* had their way. First, our advance aerodromes would have been destroyed together with such aircraft as were grounded there. Then, attacks would have been made on more distant aerodromes, our fighters meanwhile being shot out of the sky. Then our ports, harbours, towns and cities would have been systematically and methodically bombed until the horrors of Warsaw and Rotterdam were reproduced a thousandfold. Then . . . with the way cleared, would have come the final onslaught on the island.

The First Minute

The birth of the eight-gun fighter can be traced for all practical purposes to a blue foolscap minute, within the red covers of a secret Air Ministry file. In considering the eventual replacement of the Fury and Bulldog this minute was submitted, setting out the performance of a fighter with four, six or eight guns. This was on April 4th, 1933. It was signed by the late Wing Commander A. T. Williams.

The Fury replacement, then contemplated as a biplane, could take one of three forms: four, six and eight guns. The estimated comparison of performance was given as:—

	4-GUN	6-GUN	8-GUN
Maximum speed ..	265 m.p.h.	261 m.p.h.	256 m.p.h.
Climb to 20,000 ft. ..	7.8 mins.	8.2 mins.	8.6 mins
Service ceiling	37,500	36,500	35,400
Endurance	1.7 hours	1.7 hours	1.7 hours

(These figures bear no relation to present-day performances)

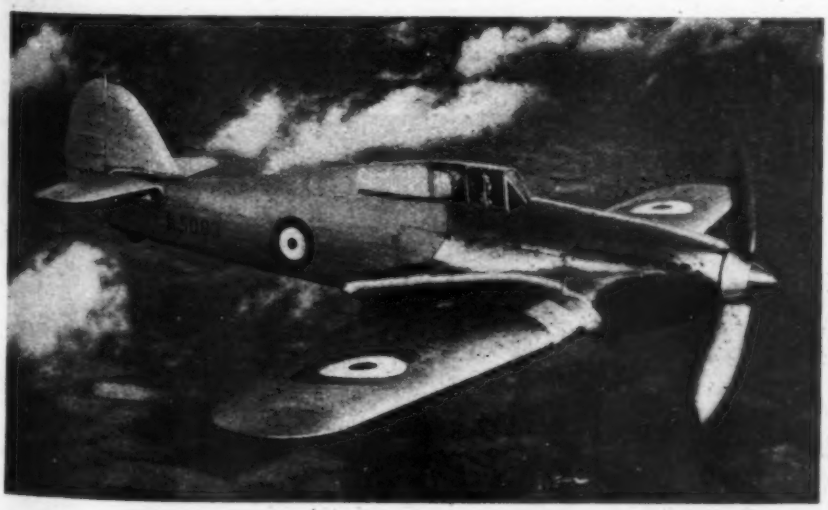
These performance figures were only paper estimates, however, and were not far enough in advance of what the aircraft then building could do. This project, therefore, was not continued.

The question still remained:

"How was the future menace of the day and night bomber to be met by fighter aircraft?" Discussion went on over the compromise of a day-and-night fighter. Would this aircraft, however, have sufficient performance and hitting power for day fighting on the one hand, and sufficient endurance and ability to locate the enemy at night on the other? One alternative was to concentrate on a high-performance single-seater for day fighting.

The Arrival of the Monoplane

Much else was discussed after the first minute of 1933 had broached the subject. The pros and cons of the four- and six- as against the eight-gun fighter had to be thrashed out, and some opposition overcome, one of the objections being that the extra armament would have the effect of making the aircraft too slow to be of practical use and would abnormally increase head resistance. But by that time the advent of the monoplane had made possible the installation of all eight guns within the wings, with less adverse effect upon performance. This also brought about a new departure from previous practice in that all guns could be mounted clear of the airscrew discs and so eliminate the need for synchronised guns firing through the airscrew. In the light of his investigations, new predictions were then submitted by Air Vice-Marshal R. S. Sorley (then a Squadron Leader engaged on staff work in connection with operational requirements) showing that the extra guns meant the loss of only 1 m.p.h., an extra 40 seconds in the time taken to reach 20,000ft., and a service ceiling of only 1,000ft. less. (These figures again have no relation to present-day performance.) The experts decided that these slight losses were more than counterbalanced by the great advantage of the additional guns, the objective being to obtain a decisive result in combat in as short a period as possible. This period was taken to be two seconds of fire, as it was estimated that in war the average pilot would be able to hold his sights steadily on his target for no more than two seconds at a time. With eight guns a deadly density of fire would be built up.



THE VERY FIRST HURRICANE : The first test flight was made in the early autumn of 1935 by Mr. P. W. S. Bulman.

UNTO CAESAR

The Claims of the Cannon

About this time, the development of the Hispano "moteur-cannon" in France somewhat complicated the issue, because it was claimed that a single hit by this gun would prove fatal. This gun was then in its infancy and had at that time the disadvantage that for purposes of rigidity it had to be mounted on the engine and fired through the airscrew boss. The argument was whether the chances of hitting the enemy with one gun of this calibre were as good as with eight machine guns. This again was well thrashed out, and a decision was taken at a conference held at the Air Ministry in August, 1934. It was not until November, 1934, that a final specification was sent out by the Air Ministry setting out the requirement—"eight machine guns." Mock-ups were then in hand for two monoplanes with the conventional armament of four machine guns mounted in the fuselage—later to become the famous Spitfire and Hurricane. These were soon converted to the new conception, and so convinced were a band of enthusiastic officers of the possibilities of the eight-gun fighter that Air Vice-Marshal Sorley advocated planning for production before the contemplated machines had reached the prototype stage.

In May, 1935, the then Squadron Leader Sorley advocated the unorthodox procedure of risking the cost of the jigs and tools for both the Hawker and Supermarine aircraft so that, while the prototypes were being completed, flown and proved to be the aircraft their designers meant them to be, the necessary preparation for production could be completed. His wishes were not granted completely: the days of ordering aircraft "off the drawing board" had not arrived.

To the late Mr. R. J. Mitchell, of Vickers, Ltd., and Mr. Sydney Camm, of Hawker Aircraft, Ltd., both famous designers, much of the credit goes for the development and ultimate adoption of the eight-gun fighter. Belief in the ability of these two men played a large part in determining Air Vice-Marshal Sorley's strong attitude. These two men were untiring in their efforts to produce the machines which later were to do so much to beat back the Nazi hordes. The ultimate confirmation of the faith of these two great designers and the R.A.F. officers who believed in them only came when the first British eight-gun fighter showed in combat with the enemy that its armament could be destructive in a very few seconds.

An Engine to Fit

There would have been little chance, however, of these aircraft becoming the scourge of the *Luftwaffe* in the British skies during the summer of 1940, if British engineering had not at the same time produced a superlative liquid-cooled engine. In the Rolls Royce Merlin II the designers of the Spitfire and Hurricane were given that performance, power and, above all, shape which enabled them to produce the clear streamline of Fighter Command's first aircraft which would fly in excess of 300 m.p.h., fire eight instead of four guns and climb higher than any operational aircraft had done before.

If this revolutionary change of policy in aircraft design had not been decided upon we might have found ourselves with fighters insufficiently armed to deal with the German bombers, put into production soon after Hitler came to power. British design and foresight proved a match for German mass planning and ruthlessness. This courageous decision with all its attendant risks was more than justified, the words "Achtung, Schpitfeuer" becoming a death knell of hundreds of *Luftwaffe's* finest pilots.

As a sidelight on the Hurricane and Spitfire, it is more than interesting to recall the words of a Flight Sergeant of the Royal Air Force, who has said that during the Battle of Britain, these aircraft were repaired and sent back into the air time after time each day. A true indication of the fact that quality is far superior to quantity.

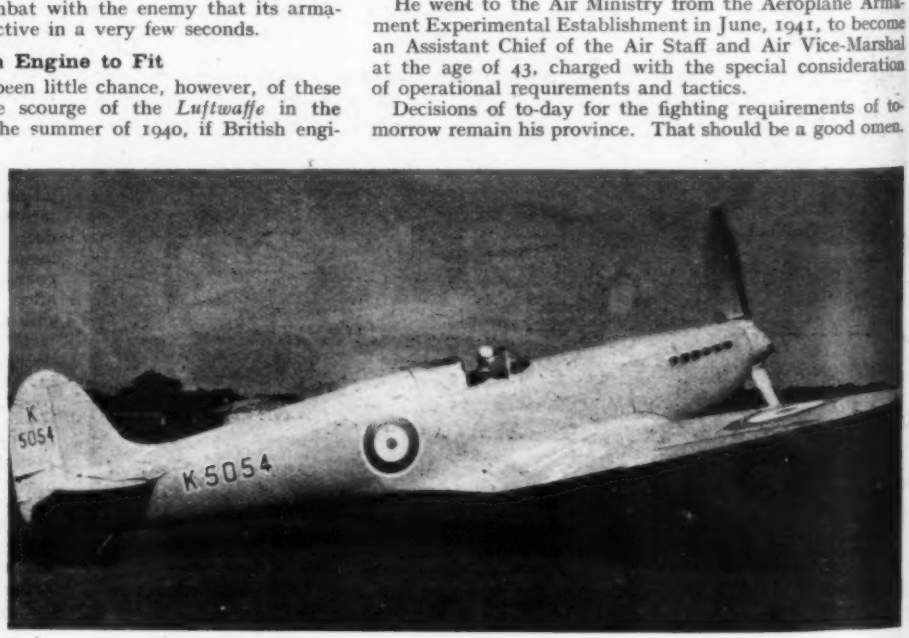
Continuity of Service

Wing Commander Arthur Trafalgar Williams died in 1934, a little more than a year after he had first introduced eight guns into official discussions on fighter requirements. He had followed his aeronautical bent from the Army into the R.F.C. in 1916. He saw much active service but his career in the Royal Air Force generally tended towards the technical side, where his strongest interest lay. Technical training and air staff duties alternated in his service life, and he went through courses at both the Staff College and Imperial Defence College.

Air Vice-Marshal Sorley entered the R.N.A.S. in the early months of the 1914-18 war before he was seventeen. Attacks on the German warships "Goeben" and "Breslau" won him the D.S.C., and he earned his D.F.C. for gallantry in 54 bombing raids. When he was able to develop his R.A.F. career at the close of hostilities he took a keen interest in experimental work and general research and development. He was the 1935 winner of the Gordon Sheppard Memorial Essay and was awarded £200 by the Inventions Awards Committee for introducing the container method of carrying bombs on aircraft.

He went to the Air Ministry from the Aeroplane Armament Experimental Establishment in June, 1941, to become an Assistant Chief of the Air Staff and Air Vice-Marshal at the age of 43, charged with the special consideration of operational requirements and tactics.

Decisions of to-day for the fighting requirements of to-morrow remain his province. That should be a good omen.



THE ORIGINAL SPITFIRE: Of stressed-skin construction, this took somewhat longer than the Hurricane to get into production. Both had two-bladed wooden airscrews.

AN AIRACOBRA SQUADRON

LATEST ACQUISITION. A squadron of Airacobras lined up on an R.A.F. aerodrome and ready for action.

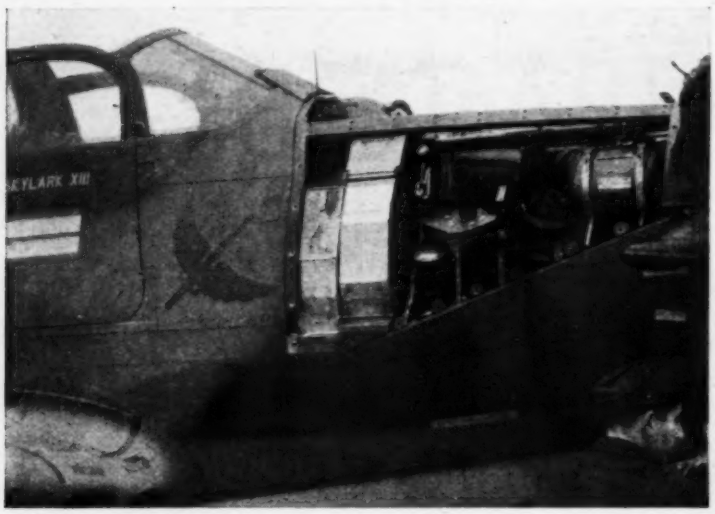
American Fighter Aircraft in the Royal Air Force

A SQUADRON Leader, who won the Distinguished Flying Cross in the Battle of Britain and has had eight confirmed victories over enemy aircraft, now commands a famous fighter squadron which has recently been equipped with the Bell Airacobra fighter aircraft. He is very proud of the distinction, and so are his pilots; they include men from all parts of Great Britain, from three of the great Dominions, several Czechs, and recently there was also a Singalese pilot. To a representative of *Flight* the Squadron Leader explained that the Airacobra is in some ways the most modern aircraft in the world, at any rate the most modern fighter. It is a specially designed machine, full of new ideas. Its outstanding features (with which readers of *Flight* are already familiar) are the position of the liquid-cooled Allison engine (of 1,150 h.p.) behind the pilot, with shaft drive to a tractor airscrew in the nose, and a nose-wheel undercarriage. There are other features, but not all of them are yet for publication.

Naturally, two questions which the Squadron Leader was asked were whether the nose-wheel stood up well to rough landings, and whether the engine showed any tendency to move forward into the small of the pilot's back. To both he was able to give satisfactory answers. The Airacobra was designed to work off runways, and the aerodrome where his squadron is stationed is far from resembling a croquet lawn, but all the same the nose-wheel has stood up well. It ought to do so, for its strut looks very solid, not to say heavy; and, as a matter of fact, the machine altogether is heavier than British standard single-seater fighters. The squadron has had one breakage of this member from an unusually heavy landing at night, and three other cases of damage, which were not serious.

The figures beyond the wing indicate the small size of this neat fighter. Note the air-intake behind the cockpit fairing and the fillets at the wing roots.

AN AIRACOBRA SQUADRON



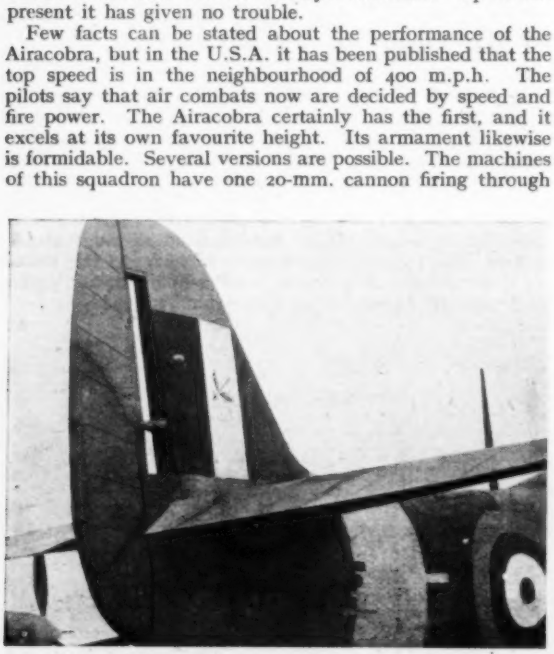
UNDER THE BONNET. With the engine amidships, there is more room in the nose for armament fittings. The barrels of the fuselage machine guns and the ammunition feed are clearly shown in the above picture, and on the right is shown the nose-wheel and the muzzle of the 20-mm. cannon.

There have been no serious accidents, but in some landings which might have been better the engine did not move from its bed, and showed no sort of inclination to do so. The squadron feels no anxiety on that point.

As for maintenance of the engine, it was treated with the same care as the Merlins in British fighters, and the squadron did not know what its flying life would be before it had to be taken out for a major overhaul. Up to the present it has given no trouble.

Few facts can be stated about the performance of the Airacobra, but in the U.S.A. it has been published that the top speed is in the neighbourhood of 400 m.p.h. The pilots say that air combats now are decided by speed and fire power. The Airacobra certainly has the first, and it excels at its own favourite height. Its armament likewise is formidable. Several versions are possible. The machines of this squadron have one 20-mm. cannon firing through the airscrew hub, two machine guns in the nose which fire through the arc of the airscrew, and four machine guns in the wings. The amount of ammunition carried is impressive, and no doubt the enemy would like very much to know the precise figures.

The Airacobra as built for the R.A.F. is in some particulars different from the form in which it is used in the United States. Our men, too, after receiving their machines, have themselves introduced some modifications. These will be notified to the Bell Company and will be incorporated in future deliveries. It was mentioned also by the squadron that all the spares did not arrive with the machines, and this was a bit of a nuisance. But R.A.F. aircraftmen are ingenious, and the machines have not been kept aground by the non-arrival of the spares. The squadron presumes that the said spares had been despatched, but had gone astray somewhere on the way. We may recall that some-



TAIL UNIT. Showing the nicely proportioned fin and the balanced rudder with trimming tab. Note the white tail-light mounted near the rudder post on the side of the fin and the first-aid compartment in the side of the fuselage just behind the R.A.F. roundels.

POWER HOUSE. The pilot's cockpit, with the Allison engine located immediately behind, has a beautifully streamlined transparent cover carefully proportioned so as not to interfere with the air-intake. Note the six exhaust stubs with "pinched" outlets from the starboard bank of cylinders.

THREE-POINTER. Nose-wheel undercarriage greatly simplifies landing, and here an R.A.F. pilot is seen making a perfect three-pointer of the new sort with flaps well down.

thing of the same sort happened in the case of machines delivered to the Russians, who had to manufacture the necessary tools before they could erect the aircraft. But things will sometimes go astray in time of war, and it is not suggested that the Americans were careless in the matter. Everyone knows how anxious they are to help the Allies.

One very good point about the Airacobra is the splendid view which the pilot gets behind him by simply turning his head. It is a very important matter in a dogfight, and this American machine is about the best of the lot in that respect. The entrance to the pilot's cockpit is through a side door, not through the opening at the top. In fact, the top of the transparent cover does not open, and this means that very tall pilots can hardly be comfortable inside. It is preferable to pick pilots of not over 5ft. 10in. The Americans also suggested putting a limit on the weight of the pilot, but so far this squadron has not found it necessary to stick to the limit which the designers suggested. When a pilot has to do a "brolley hop" (it has not yet been necessary) there is a quick release of a door in the side, and the pilot rolls out on to the wing, and then off that into open air. That obviates the manœuvres which are found advisable when a man has to quit a Hurricane or Spitfire.

Of the flying qualities of the Airacobra nothing but high praise was heard from the pilots, even though some of them who had been before in Hurricane squadrons had got so attached to their old machines, as pilots will, that they felt rather homesick for them.

(Left) An instructive close-up of the nose-wheel unit showing the telescopic leg and retraction member. The cable from a starter-battery can be seen on the left. (Below) With flaps partially lowered to increase lift, the Airacobra gets off briskly.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters

NAMES TO INSPIRE

Christening Our New Aircraft

THROUGH the medium of your columns, I would like to appeal to those authorities who are responsible for the nomenclature of our newest type of aircraft.

I would point out that there are definite advantages to be gained from the careful choice of appropriate designations in these unusual (!) days and I, for one, would like to see the names of R.A.F. men of the last war revived for this purpose. Their tradition is as strong to-day as at any time, and one can readily visualise its moral effect on our present-day air crews, the majority of whom were not even born at that time.

I prophesy, too, that it would not be unpopular with the general public, and that goes for the peoples of our Dominions as well.

November 11th is not the only day when their names and their memories should be an inspiration to us. Let the Nazis know that McCudden and Ball and the rest are alive to-day.

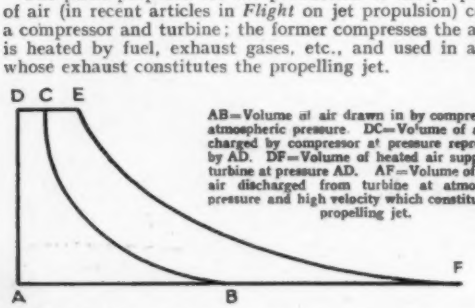
G. A. CHAMBERLAIN.

JET PROPULSION

The Case Against Its Use for Aircraft

THE idea of jet propulsion was tried out in Naval vessels many years ago and failed for two main reasons, the first being the space taken up in the ship by the pipes leading water to and from the pump for producing the propelling jet, and the second the low efficiency of the system. As regards the latter, it is well known that the propulsive force for a vessel is obtained from the reaction due to driving a column of water astern; the forward thrust is proportional to the weight of water passing through the impellor and the sternward velocity imparted to it by the impellor. From an efficiency point of view, many experiments have confirmed that the highest efficiencies are obtained by imparting a low sternward velocity to a large weight of water. In the case of jet propulsion of ships, this meant large diameter pipes which took up too much space in the vessel's hull which was urgently required for other purposes. The same principles govern the propulsion of aircraft which are propelled by the reaction obtained by imparting sternward velocity to a mass of air, commonly described as the slipstream. Efficiency is obtained by the use of large-diameter geared propellers, which handle a large weight of air and so reduce the slipstream velocity for a given thrust. Jet propulsion of aircraft also embodies the principles stated above. And efficiency of propulsion, upon which depends the weight of fuel to be carried—with its effect on pay load, radius of action, etc.—can only be obtained with jet pipes or passages of large diameter or area from which air issues at speeds 30 per cent. or so greater than the speed of the plane. The size of the pipes or passages required would make very serious inroads on the already restricted space available in the fuselage of an aeroplane.

The plant proposed for the production of the propelling jet of air (in recent articles in *Flight* on jet propulsion) consist of a compressor and turbine; the former compresses the air which is heated by fuel, exhaust gases, etc., and used in a turbine whose exhaust constitutes the propelling jet.



AB=Volume of air drawn in by compressor at atmospheric pressure. DC=Volume of air discharged by compressor at pressure represented by AD. DF=Volume of heated air supplied to turbine at pressure AD. AF=Volume of heated air discharged from turbine at atmospheric pressure and high velocity which constitutes the propelling jet.

The working cycle is shown in the accompanying diagram in which AB represents the volume of air at atmospheric pressure drawn into the air compressor and compressed to a volume represented by CD and pressure represented by AD. This volume of compressed air is now heated by combustion of fuel and exhaust gases to a volume DE; after which it is allowed to pass into the turbine, which drives the compressor. In passing through the turbine the air falls in pressure from AD to just above atmospheric pressure and its volume increases from DE to AF. The volume AF of air and products of combustion exhausted, or discharged, at high velocity through a suitably shaped nozzle are used for propelling the aircraft. The difference between the two areas AFED and ABCD is the energy available for propulsion.

It will be noted that two machines are required to produce the jet, and the useful effort is the difference between their outputs. A similar example, but on a much larger scale, is the turbo-compressor electric generating set at Neuchatel, Switzerland, which consists of a compressor, heating chamber and turbine, which drives the rotary centrifugal air compressor. The turbine for this set generates approximately 15,700 kW. Of this, 11,500 kW. is required to drive the rotary compressor, and the difference—some 4,200 kW.—is the net output of the alternator driven by the set.

It will be seen that the output of a power plant working on this principle is out of all proportion to power required to operate the turbine and its compressor. The weight of a compressor in addition to an aero engine renders a plant of this type impracticable for use in an aeroplane. The ordinary aeroplane engine is its own compressor, one stroke of the piston out of every four strokes being used for this purpose. Further, the ratio of compression in one stage of a high-speed centrifugal rotary air compressor is small, and some 13 stages of fairly large diameter are required to produce an air pressure of 100lb. per sq. in.

It is doubtful if a shaft with 13 impellors on it, driven by a turbine, with the necessary heating chamber and discharge piping, could be accommodated in an aeroplane of practical design.

To start up a turbo-compressor plant of the type advocated for jet propulsion requires a powerful motor in order to drive the compressor up to its working speed. This would entail the provision of a mobile starting unit for use on the aerodrome. But the difficulty does not end here, for if the plant stopped in the air it would be impossible to start it again.

Another inherent difficulty with the high-speed turbo-compressor is the yawing and pitching effects due to gyroscopic action which would adversely affect the manœuvrability of the aeroplane.

Another fact which must not be lost sight of is that the momentum of the air discharged from the jet of a jet propelled aeroplane during flight must be equal to the momentum of the air discharged from the propellers of a normal aeroplane of similar size and speed. Jet propulsion virtually amounts to putting the engine and propeller inside the fuselage of the machine—a rather impracticable idea.

The foregoing restrictions would appear to preclude the use of jet propulsion for aeroplanes, but it is considered that arrangements might be made within the limits of weight and space available to use the energy in the exhaust gases (especially in the case of a supercharged aero engine) to drive a small high-speed turbine flexibly geared to an extension of the engine crankshaft to augment the power and even the power-weight ratio of the engine. This is considered to be worth while trying, observing that approximately 40 per cent. of the energy of the petrol used as fuel is carried away in the exhaust gases.

HERBERT C. B. READ,
A.M.I.Mech.E.

Theoretical Limit

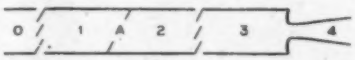
YOUR articles on "Jet Propulsion" have been most interesting. They are especially concerned with various attempts to get the nearest approach to the theoretical limits of the jet system.

May I put before your readers a few figures, with formulae, to indicate these limits, and to help them compare this system with the conventional one? The formulae are based on the ideals of adiabatic expansion and compression, with air as the working medium throughout, as is done in calculating the "Air

CORRESPONDENCE

Cycle Efficiency" in the conventional internal combustion engine.

For reference, the cycle is divided up into stages, as shown in the diagram. The air enters at stage O, passes through the the compressor to stage 1, past the fuel injectors and spark at A to stage 2, to the turbine (which drives the compressor), out to stage 3, and then through the final jet to the atmosphere at stage 4. The condition of the air at any stage is indicated by using the number of the stage as a suffix; i.e. P_4 is the pressure at stage 4.



In the treatment of the take-off, the resistance is assumed to vary as the square of the velocity, in fact to equal $A + Bw^2$ where A and B are constants. I have taken the figure for A of 0.03M, as suggested by Dr. Lanchester in his article in *Flight* of 4th Sept.

The figures have been chosen as the best for a ground level, level flight, speed of 340 m.p.h. (500 ft./sec.). The theoretical figures being unattainable, a loss over the turbine and compressor of 25 per cent. is allowed for. Under these conditions, the jet unit should have an exhaust temperature T_4 of 127 deg. C (400 deg. A), a mass of air passing per sec., m, of 30 lb./sec. and a turbine with eight "Rateau" or impulse wheels. (Inlet velocity to turbine assumed 1,000 ft./sec. Exit velocity = 1,000 cos. 30 deg. = 500 ft./sec.).

For comparison, take an equivalent aeroplane of the same loaded weight and performance. This would have (if a fighter) a loaded weight M of 7,000 lb., an engine with 1,000 b.h.p. for level flight and 1,100 b.h.p. for take-off, a take-off run of, say, 1,400 ft. and a take-off speed of 140 m.p.h. (200 ft./sec.). The petrol consumption at 340 m.p.h. would be rather over 70 gallons per hour.

(I assume the use of petrol for the jet unit for simplicity, but other fuels of higher calorific value would probably be more suitable and easier to obtain.)

Given the above:—

T_2 = 525 deg. C. (798 deg. A)
P_2 = 170 lb./sq. in.
Power from turbine = 5,120 h.p.
Power used in Compressor = 3,660 h.p.
Power Losses = 1,460 h.p. (28.5 per cent.).
Petrol Consumption = 80 gals./hr.

The diameter of the propulsion jet for the above unit would be approximately 8 in. at the throat.

For an equivalent take-off, the jet reaction, F, must be 4,000 lb. compared to 1,100 lb. for level flight, i.e., 3½ times as much as for level flight. It has been suggested that true "Rocket" jets might be used for such short periods, and if used solely for take off, they could be jettisoned once the machine was in the air. I append the formulae and data from which these figures were obtained.

Symbols

M = Loaded weight of aircraft.
u = Aircraft velocity.
m = Mass of air passing per sec.
C = Calorific value of fuel.
F = Jet Reaction.
N = Number of Rateau wheels in turbine. The inlet nozzles are presumed to be at an angle of 30 deg. to the plane of the wheels.
P = Pressure.
T = Temperature (Absolute).
V = Velocity of gases.
s = Take-off Run.
w = Speed at end of Take-off.

Constants used and other data.

R = 96 ft. lb. per lb. per C. Atmospheric Pressure = 15 lb./in.²
K_p = 336 ft. lb. per lb. per C. Atmospheric Temp. = 7 deg. C.
K_v = 240 ft. lb. per lb. per C. 1 gallon of petrol weighs 7.2 lb.
C = 1.5 × 10⁶ ft. lb. per lb. for petrol. $\gamma = K_p/K_v = 1.4$.

Formulae

For level flight.

$$F = \frac{m(V_4 - u)}{g} = \frac{H.P.}{u}$$ H.P. is the tractive horse-power.

$$T_2 = T_4 + \frac{V_4^2 - V_2^2}{2K_pg} + \frac{N(V_2^2 - V_3^2)}{2K_pg} \qquad \frac{R\gamma}{\gamma - 1} = K_v.$$

$$P_1 = P_2 = (T_2/T_4)\frac{\gamma}{\gamma - 1} \cdot P_4$$

$$T_1 = (P_1/P_0)\frac{\gamma - 1}{\gamma} \cdot T_0 = \frac{T_0 \cdot T_2}{T_4} \qquad P_0 = P_4.$$

$$\text{Fuel. Lb./hr.} = \frac{3600.mK_p(T_2 - T_1)}{C}$$

$$\text{Work from turbine} = \frac{3.NmV_2^2}{8g} \text{ ft. lb. per sec.}$$

$$\text{Work done in Compressor} = mK_vT_0(T_2/T_4 - 1) \qquad \frac{R}{\gamma - 1} = K_v$$

For a conventional aeroplane the power at take-off does not vary with the speed; with jet propulsion, the reaction remains constant (sensibly) so the power varies with the speed.

For Conventional type:

$$\text{(H.P.)} \cdot s = \frac{Mw^3}{3g} + e^{dw}. \quad (Aw - A/d + Bw^3 - 3Bw^2/d + 6Bw/d^2 - 6B/d^3)$$

where $d = \dfrac{\log.(s+1)}{w}$

For Jet Propulsion type:

$$s = \frac{M}{2gB} \cdot \log_e\left(\frac{F - A}{F - A - Bw^2}\right)$$

O. LAWRENCE, M.A.

CONTRA-ROTATING AIRSCREWS

Opposite Loads Cancel Torque

THE interesting correspondence which has recently been published in *Flight* re contra rotating propellers seems to prove that there exists some diversity of opinion. Primarily it must be conceded that the torque forces produced at an engine are dependent upon the load quantity and not the nature. Power may be expended creating air disturbance, generating electricity, or developing heat by friction; the torque is not affected in any way by these things.

With regard to Mr. Abel's letter, the power expended by an airscrew in a vacuum is zero, and therefore the load is zero and also the torque. Mr. Watts, I suggest, has lost sight of the fact that the engine is accepting two torques. First, the pure torque between direct-driven shaft and engine, and, secondly, the torque between the contra prop. and the engine through the gear box. If the loads are equal and in opposite rotation, then the torques are equal and in opposite effect, cancelling one another. Mr. Hadekel's remarks seem to me to sum up the situation effectively.

I think the following statements can be proved both theoretically and by practical experiment.

1. The direction of the torque reaction is opposite to the direction of rotation of the shaft carrying the load.

2. The torque forces always act around the centre line of the load shaft.

If these statements are questioned I should be happy to produce the necessary arguments and provide calculations for any particular set of circumstances, if your space permits.

G. HAWKYARD.

A Model Demonstration

RE contra props, therefore further to "A.B.C. of Torque," there appears to be some muddled thinking on this subject, and it appears to me that the easiest way to explain its functions and effect is as follows:

Ex. 1:
Eng.: Rev. anticlockwise.
Prop.: ,, ,,
Therefore torque reaction clockwise.

Ex. 2:
Eng.: Rev. ACW.
Prop.: ,, CW.
Therefore torque reaction anticlockwise.

Regardless, then, of the direction of rotation of the crankshaft, the torque reaction affecting the aircraft as a whole depends upon the direction of rotation of the airscrew.

This is proved by running the engine with the airscrew removed, and it will be found that only slight torque will be set up during periods of acceleration. It is plain, therefore, that until external resistance is applied against free rotation there can be no reaction.

Two airscrews revolving about the same centre in the same direction will create twice the torque of one, the degree depending upon the fineness or coarseness of the blade pitch. To revolve them in opposite directions, therefore, would eliminate reaction upon the aircraft.

Try it on an elastic-driven model!

"ELEMENTARY, MY DEAR WATSON."

HERE AND THERE

Lop-sided DC-3

NEWS of an emergency repair carried out to an American airliner operating in China is of particular interest in view of the discussion on asymmetrical aircraft which was recently held in the Correspondence columns of *Flight*.

A DC-3 had its starboard wing shattered on the ground when the field was dive-bombed by five Japs, and the only available replacement was a DC-2 wing which was about seven-eighths the span of that of the DC-3, though of the same chord. This was duly fitted and the machine flown 860 miles back to Hong Kong using full aileron tab.

Luftwaffe Identification

A REVISED edition of the *Flight* identification chart of German aircraft is now on sale, price 1s. 3d., postage 6d. extra for single copies, 7d. up to three copies and 8d. up to six copies. Several new types in use by the *Luftwaffe* are depicted, including ME 109E, FW 189, and the Focke-Wulf Kurier, and the silhouettes of others have been modernised.

As previously, broadside, head-on and underside views are provided showing the chief characteristics, but they are now also detailed in the text further to assist identification.

The chart comprises 15 silhouettes of the leading types of German aircraft supplemented by 44 line drawings. The size is 13½ × 20½in. holed and corded ready for hanging, and supplies can be ordered from the Flight Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1.

"*Flight*" photograph.

STIRLING BOMB RACKS: Over half the length of the 87ft. fuselage is devoted to bomb storage. Our photograph shows the commencement of "bombing-up." On the trolley are four 1,000-pounders, but there are plenty more to come before the Stirling takes off. The excellent visibility of the bomb-aimer's compartment is also shown.

Guild of Air Pilots

PARTLY owing to their journal being out of circulation for the time being, the Guild of Air Pilots and Air Navigators of the British Empire is finding it difficult to keep in touch with their members.

The Clerk of the Guild, Laurence A Wingfield, M.C., D.F.C., would therefore be glad if members would notify him of any change of address.

The present temporary address is 309, Crofton Road, Orpington, Kent.

Glider Fuel Tankers

ACCORDING to reports from America, the British Air Commission is understood to have asked for specifications from American sailplane manufacturers for a "flying gas tank" glider for fuelling bombers after take-off. By this means a glider carrying some 500 gallons of fuel takes off towed by the heavy-laden bomber to which it transfers its fuel almost as soon as they leave the ground, thereafter cutting loose and returning to the aerodrome.

The use of glider-tankers instead of power-driven craft for this purpose would, of course, be much cheaper, but there are fairly obvious disadvantages.

A Chaplain Appeals

SOME 700 young men undergoing wireless technical training at two R.A.F. centres on the outskirts of London are at present deprived of the ordinary amenities of camp life because they have to be billeted out, so it is intended to start a club for them.

The Chaplain of the Station, the Rev. F. W. Bowyer, is therefore appealing for gifts in the form of sports equipment. Gifts should be sent to the Rev. Bowyer, c/o The Air League of the British Empire, Kinnaird House, 1a, Pall Mall East, London, S.W.1.

COLD COMFORT: In order that the bitter Canadian winter shall not interfere with the Empire Training Scheme, the Tiger Moths have been fitted with coupé tops to keep out the below-zero draught.

THE THREE MARTINS

B-26 is Now Officially Known as the "Marauder"

THE present habit of bestowing names of our own choice upon the very excellent aircraft leased and lent to us by America is, though attractive, apt on occasions to lead to a certain amount of confusion.

Readers will not yet have had time to forget that the Bell Airacobra was first changed to Caribou and then changed back again. Caribou was a singularly inappropriate name, of course, and it should not have needed an expert on North American fauna to tell anyone that this was a clumsily-built animal; a ten-second glance into the *Encyclopædia Britannica* would have sufficed!

The story of The Three Martins is rather different. There never was any trouble over the first (the 167 W), which has always been known here as the Maryland. Seeds of confusion were sown, however, with the advent of the B-26, which was a very different-looking Martin whose British name, so rumour first had it, was to be the Baltimore. *Flight* was preparing its chart of American aircraft at the time and sought a ruling on the matter from Millbank,

THE BALTIMORE (187): It resembles the Maryland but has a deeper-sectioned fuselage which drops down at the upper gun-turret amidships. The trailing-edges of its wings are "webbed" to the ends of its long engine-nacelles.

pointing out that there were very good reasons to suspect that the Baltimore was, in fact, the more recently leased and lent Martin 187, though it was designed before the B-26, which bore a close external resemblance to the Maryland.

But the voice of Millbank, over the telephone, insisted that, so far as it knew, the B-26 was the Baltimore, and it went all coy at the mention of the Martin 187, concerning which no information was forthcoming. It admitted having heard the name Marauder mentioned, but intimated that it certainly possessed no *locus standi* at the M.A.P.

Subsequently it was officially announced that the Martin 187 would be known in the R.A.F. as the Baltimore, but, so far as the B-26 was concerned, well, it *might* eventually be called the Marauder or, again, it might be christened the Montreal! Glenn Martin advertisements in American journals, meanwhile, continued to bestow upon it the colourful title of the Flying Torpedo.

THE MARAUDER (B-26): A larger machine than the other two Martins, it is beautifully streamlined and has a neatly faired gun position in its tail. Note the mounting of the wings almost amidships and the long nacelles.

THE MARYLAND (167W): Doing wonderful service with the R.A.F. in the Middle East; it can be identified by the comparatively small section of the rounded nose and the step-up in front of the tailplane as shown on the drawing below.

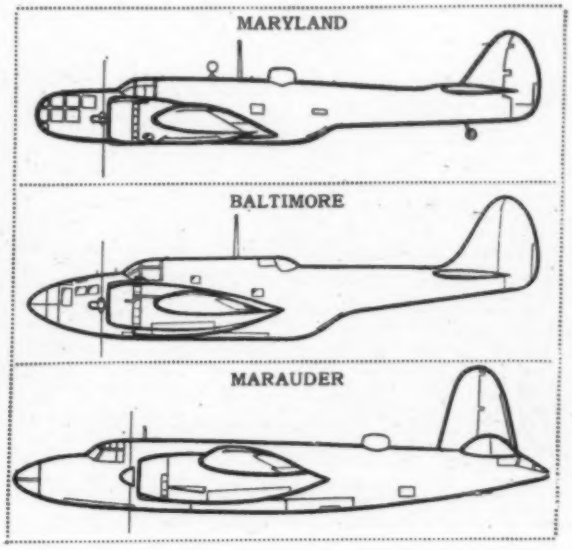
But the point is now settled; the M.A.P. has recently stated officially that the Martin B-26 bomber is to be known in this country as the Marauder, and to make quite certain that no shred of confusion remains in the minds of its patient readers, *Flight* herewith publishes, again, pictures of (top, right) the Martin Maryland, (centre, left) the Martin Baltimore, and (bottom, left) the Martin Marauder, together with line drawings (bottom, right) showing the differing shapes of the three respective side elevations.

Characteristics at a Glance

These illustrations show that the most noticeable difference between the Maryland and the Baltimore is that the latter has a much deeper forward section to its fuselage, which drops down at the upper gun-turret amidships, whereas that of the Maryland runs level from the pilot's cabin to a step-up just in front of the tailplane, a retractable turret being fitted amidships. The Maryland also has a fixed tailwheel, but the Baltimore has a retractable one.

The Marauder, of course, is quite distinctive in its smooth streamlined fuselage, and has a retractable "tricycle" landing gear. The mounting of the tapered wings almost amidships, tailplane dihedral, tall symmetrical fin and rudder and the projecting "tails" of the engine nacelles are all easily recognised characteristics of this aircraft.

The Maryland has a span of 61ft. 4in. and a length of 46ft. 8in. It is powered by two Pratt & Whitney Twin Wasp engines of 1,050 h.p., which give it a speed of 275 m.p.h. and a ceiling of 29,500ft. Its range is approximately 1,300 miles. No details have yet been released about the Baltimore, and all that can yet be said about the Marauder is that it has Pratt & Whitney 14-cyl. Double Wasp engines of 1,500 h.p.



Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

BAR TO THE DISTINGUISHED FLYING CROSS.

Act. Wing Cdr. A. L. BOCKING, D.F.C., No. 11 Sqn.

Act. Wing-Cdr. J. A. KENT, D.F.C., A.F.C.

This officer has led his wing in an efficient and fearless manner on many operational sorties within the last two months. He has destroyed a further six enemy aircraft, bringing his total successes to 13 destroyed and three probably destroyed. Wing-Cdr. Kent has set a grand example.

Act. Wing Cdr. R. J. WELLS, D.F.C., No. 108 Squadron.—This officer has led his unit with great success. In attacks on Tripoli, six ships were sunk and hits were obtained on many others. Widespread damage was caused at various other places. At Messina, in particular, the whole railway sidings, including many trucks, were destroyed, while the power house and a large adjoining area were completely burnt out.

Throughout the short period of less than a month, Wing Cdr. Wells organised and directed a very large number of sorties which were carried out by his unit, and participated in fifteen of them himself. He has at all times displayed outstanding leadership, courage and determination.

DISTINGUISHED FLYING CROSS.

Flt. Lt. A. C. RAWLINSON, R.A.A.F., No. 3 Sqn.

Act. Flt. Lt. John Mervyn DENNIS, No. 45 Sqn.

Act. Flt. Lt. Kenneth Henry Osborne YOUNG.

F/O. P. St. G. B. TURNBULL, R.A.A.F., No. 3 Sqn.

Act. Flt. Lt. C. G. PETERSON, R.A.F.V.R., No. 71 (Eagle) Squadron.—This American pilot has led his flight with initiative and determination during the past three months. He has participated in forty-two operational sorties and has destroyed two, probably destroyed a further two, and damaged one hostile aircraft. His coolness and courage have set an excellent example.

F/O. G. A. DAYMOND, R.A.F.V.R., No. 71 (Eagle) Squadron.—This American pilot has taken part in twenty-seven operational missions, including sorties over Northern France and convoy patrols. He has always shown great courage and keenness to attack the enemy and he has destroyed five of their aircraft.

Wing Cdr. R. G. YAZLEY, M.C., No. 252, Squadron.—This officer commanded a detachment of fighter aircraft which recently carried out a series of sorties with the object of assisting in the safe passage of our convoys in the Mediterranean. Attacks were made on certain aerodromes and seaplane bases which resulted in a loss to the enemy of at least 49 aircraft and a further 42 damaged.

The successes achieved undoubtedly contributed largely to the fact that the convoys were able to proceed without loss; only one ship was damaged, but it succeeded in reaching port. The courageous leadership and determination of this officer is worthy of the highest praise and, throughout, he set an example which proved an inspiration to his fellow pilots.

Flt. Lt. D. H. WARD, No. 87 Squadron.—This officer fought with his squadron during the air operations in France and destroyed two enemy aircraft. Since September, 1940, he has commanded a flight engaged in night flying operations, and has performed excellent work, particularly in the training of new pilots.

In July, 1941, Flt. Lt. Ward and another pilot intercepted a force of hostile aircraft, which attempted to attack one of our aerodromes from a low altitude. Although the weather conditions were extremely unfavourable, at least one of the attacking aircraft was damaged.

On another occasion Flt. Lt. Ward led a successful attack on the aerodrome at Caen. In spite of anti-aircraft opposition hits were believed to have been obtained on two enemy aircraft and, in addition, a goods train was machine gunned, together with buildings and gun-posts. This officer has always displayed the greatest keenness to engage the enemy.

Flt. Lt. D. SALWEY.—This officer has displayed outstanding skill and devotion to duty in photographic reconnaissance.

Act. Flt. Lt. C. R. BUSH, No. 41 Squadron.—This officer has carried out forty-eight operational sweeps over enemy territory, and has destroyed at least three hostile aircraft. Flt. Lt. Bush also took part in the air operations in France and later fought in the Battle of Britain. He has at all times displayed courage and keenness and has set an excellent example.

Act. Flt. Lt. R. D. ELLIOTT, R.A.F.V.R., No. 72 Squadron.—This officer has been engaged on operational flying since December, 1939. He fought in the Battle of Britain, during which he destroyed four enemy aircraft. In addition to participating in many night patrols, Flt. Lt. Elliott has been largely responsible for the training of new members of his squadron. Throughout he has shown exceptional skill and courage.

Act. Flt. Lt. R. MARPLES, No. 41 Squadron.—This officer has shown great courage and leadership as a flight commander. He has carried out fifty-two operational sorties over enemy territory and has destroyed two, probably destroyed three, and damaged a further two enemy aircraft. His keenness and personal example have been outstanding.

F/O. W. I. ANSTEY, No. 70 Squadron.—This officer, as captain of aircraft, carried out seven long-distance night bombing attacks during the first fourteen days in August. Four attacks were made on shipping at Benghazi, two attacks on the Corinth canal, and one on the aerodrome at Berca. Good results were obtained on each occasion.

Throughout F/O. Anstey displayed great efficiency and physical endurance. He has completed forty-three operational missions, involving nearly 300 hours flying.

P/O. R. A. BEARDSLEY, R.A.F.V.R., No. 41 Squadron.—In the course of fourteen operational sorties over enemy territory P/O. Beardsley has destroyed three, probably destroyed three and damaged a further four hostile aircraft. Both as a section and flight commander, P/O Beardsley has set a fine example.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. Frank R. MASON, No. 11 Squadron.

Sgt. J. H. H. MILLS, R.A.F.V.R., No. 70 Squadron.—In September this airman was the captain of an aircraft detailed to participate in a raid on shipping in the harbour at Benghazi. Owing to engine trouble, Sgt. Mills was unable to take off with the squadron, but after a great effort, both by himself and the ground crew, the aircraft was made serviceable, and he took off two hours later.

Reaching his objective, Sgt. Mills attacked a small but vitally important ship which was used for pumping oil from tankers. He released his bombs on his second run and obtained hits, causing a fire on the ship, which was completely burnt out.

Throughout the forty-three operational missions in which he has participated Sgt. Mills has displayed similar perseverance, determination and devotion to duty.

Sgt. W. PALMER, No. 41 Squadron.—This airman has displayed great courage and coolness in the face of the enemy. On a recent operation near Dunkirk, when engaged by a superior number of Messerschmitts, his ammunition became expended, but with commendable skill Sgt. Palmer led his pursuers down low, then flew under some high-tension cables so that one of the following Messerschmitts crashed into the cables and was destroyed.

Sgt. Palmer has destroyed at least three enemy aircraft.

Sgt. N. J. A. PATON, R.A.F.V.R., No. 225 Squadron.—This airman has participated in fourteen daylight bombing attacks on enemy targets. In July he carried out a successful attack on the docks at Rotterdam. Defying intense anti-aircraft fire, Sgt. Paton pressed home his attack and obtained a hit which destroyed a vessel of 1,800 tons.

Three days later he attacked a convoy and scored direct hits on a ship of 5,000 tons. In August Sgt. Paton participated in an attack on Lille, and, despite heavy enemy fire which hit his aircraft in several places and also wounded his observer, he successfully bombed his target.

Some days later he bombed and set on fire a 2,000 ton merchant vessel in the face of heavy fire from escorting ships. Sgt. Paton's aircraft received a direct hit from a cannon shell, which wounded the observer and wrecked the instruments. Nevertheless, Sgt Paton flew his aircraft safely back to base.

He is an excellent leader, whose skill and coolness in the face of the enemy are of the highest order.

Sgt. C. P. STONE, R.A.F.V.R., No. 72 Squadron.—This airman has proved himself to be a cool, keen and resourceful pilot. Within the last two months Sgt. Stone has carried out twenty-eight sorties over Northern France. On one occasion he became separated from his unit and was attacked by four Messerschmitt 109's. He succeeded in destroying at least one of the enemy aircraft without damage to his own.

The following day Sgt. Stone destroyed another hostile aircraft. By his splendid example, often in difficult conditions, he has assisted in maintaining a high standard of morale in his unit.

CONCENTRATION : A game of backgammon in the ante room.

Roll of Honour

Casualty Communique No. 85.

THE Air Ministry regret to announce the following casualties on various dates. The next of kin have been informed.

Royal Air Force

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—Sgt. T. A. Barker; Sgt. P. W. Bryant; Sgt. W. J. Cowell; Flt. Sgt. A. Forse; Flt. Lt. H. M. Hammond; Sgt. F. J. McGaw; Sgt. A. P. A. Mackenzie; P/O. W. J. Mason; Sqn. Ldr. E. J. C. Michelmore; Sgt. J. E. Murdoch; Sgt. F. Rowney; Sgt. G. R. Simpson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. R. S. E. Aldridge, D.F.C.; Sgt.

SERVICE AVIATION

H. C. J. Brewer; Sgt. A. Drury; P/O. R. A. L. Du Vivier; Sgt. G. E. Heaysman; P/O. F. W. Holden; Sgt. A. J. Hollist; Sgt. T. G. F. Nicholls; Sgt. G. C. Pavitt; P/O. G. A. Simpson; Sgt. D. S. Wallis.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. I. H. Adkins; Sgt. J. L. Baxter; F/O. R. C. W. Broad; Sgt. L. E. E. Bundock; P/O. R. J. Burliegh; Act. Flt. Lt. M. M. Carter; Sgt. J. F. Cooper; Sgt. J. E. Crane; Act. Flt. Lt. J. Dickinson, D.F.C.; Sgt. A. Flockhart; Sgt. C. W. Fry; Sgt. T. Gamble; Sgt. A. T. H. Gillanders; P/O. C. S. Greenaway; F/O. A. G. W. Hough; Sgt. W. Hobden; P/O. V. C. Keough; Sgt. G. J. Little; Flt. Lt. M. J. C. Marks, D.F.C.; P/O. H. W. Morgan; Sgt. R. Mower; P/O. G. C. Muir; Sgt. R. Player; Sgt. J. Pringle; Sgt. N. Rowell; P/O. R. M. Sanderson; P/O. A. A. Scott; Sgt. J. Sharkey; Sgt. H. Teeton; P/O. A. L. T. Todd; Sgt. A. Turner; Sgt. J. E. Valler; Sgt. D. G. Watt; P/O. E. T. Wilkinson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—Sgt. G. Furney; Sgt. A. Gordon; Sgt. G. Humber.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. A. Tizzard.

WOUNDED OR INJURED IN ACTION.—F/O. S. B. De Mier; P/O. G. B. Girardet; Sgt. J. Mathews; Cpl. W. H. Robinson; Sgt. P. G. Smith; Sgt. D. B. Wark; Sgt. F. S. Warren; Sgt. E. Wharton; Sgt. J. White; Flt. Lt. R. W. Whittome, D.F.C.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. R. N. Barcroft; Sgt. A. J. Box, D.F.M.; P/O. H. Brant; P/O. J. P. B. Cushion; Sgt. H. J. David; Sgt. W. Ellesley; P/O. A. R. Fitch; P/O. D. S. Fraser; Sgt. G. J. P. Hartlett; P/O. B. W. M. Jones; Sgt. G. F. Lister; Sgt. G. E. Morgan; P/O. H. E. Pearson; Sgt. R. H. Rampton; Sgt. T. Robertson; Sgt. D. Slater; Sgt. A. H. Stroud; Sgt. N. Willingham.

MISSING.—Sgt. C. W. Allen; Sgt. J. Archer; P/O. R. F. Bennett; Sgt. G. G. Bensley; Sgt. M. R. Bowes; Sgt. R. F. Brian; P/O. J. W. T. Brosham; Sgt. G. H. Brook; Sgt. R. S. Bryer; Sgt. J. A. D. Clark; Sgt. A. G. Clarke; L.A/C. R. A. G. Cleave; P/O. J. R. Croucher; Sgt. F. Dacey; Sgt. P. J. Duffy; Sgt. E. V. Durham; Sgt. P. C. Eyre; P/O. H. S. Fenlaw; Sgt. A. P. J. Grandy; Act. Flt. Lt. C. E. C. Haggitt; Sgt. K. Hayes; Flt. Sgt. A. G. Hole; Sgt. H. Kay; Sgt. A. Kettlewell; Sgt. J. C. Kimberley; Act. Sqn. Ldr. J. O. Lalor; Act. Sqn. Ldr. F. A. G. Lascelles, D.F.C.; Flt. Sgt. W. D. McAdam; Sgt. W. McBeth; Sgt. T. McGill; Sgt. A. Mitchell; Sgt. H. J. W. Newnes; Sgt. W. J. Ordway; Sgt. H. D. Poole; Sgt. P. J. Pratt; P/O. C. D. Ramsey; Sgt. H. Richmond; Sgt. A. W. Rowan; Sgt. K. F. Runcorn; Sgt. A. C. Scrivens; P/O. W. J. Sears; Sgt. A. A. C. Shaddick; Sgt. H. B. B. T. Smith; Sgt. J. Spencer; Sqn. Ldr. R. H. Spencer, D.F.C.; F/O. I. H. N. Terry; P/O. W. E. Thomas; P/O. E. A. W. Thompson; F/O. E. Q. Tobin; Sgt. H. G. Tonks; Sgt. J. R. Tugman; Act. Sqn. Ldr. K. H. Walsh; Flt. Sgt. C. P. Weir; Sgt. H. V. Wilkinson; Sgt. K. P. Withyman.

KILLED ON ACTIVE SERVICE (WHILE ENGAGED ON NON-OPERATIONAL FLYING DUTIES OR ON THE GROUND THROUGH ENEMY ACTION).—Sgt. E. G. Allen; Sgt. F. W. Appleby; Flt. Lt. D. J. Bassett; Sgt. H. W. Bellingham; Sgt. G. H. Bradley; L.A/C. L. C. Brown; Sgt. M. J. Byrne; Sgt. A. D. W. Clay; P/O. D. A. Dale; Sgt. H. S. Davies; L.A/C. A. Duthie; Sgt. J. A. Eakin; L.A/C. L. E. Eales; P/O. W. Ellis, D.F.M.; Sgt. F. Grove; Sgt. J. D. Hainsworth; A/C.1 R. Hallett; Sgt. T. Highton, D.F.M.; Sgt. W. H. Jones; Sgt. R. Keen; Sgt. W. G. Kilsby; Sgt. G. F. Large; Sgt. J. R. Lee; Sgt. J. M. Loughridge; Spt. L. W. McKinlay; Sgt. E. McLaughlin; Sgt. F. V. Martin; Flt. Sgt. W. H. Morley; Sgt. G. Mortimer; Flt. Lt. A. W. H. Reader; Act. Flt. Lt. J. R. M. Sales; Sgt. C. H. T. Smith; Sgt. J. Webber; P/O. T. L. Weller.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—A/C.2 R. J. Marchant.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. R. Stoker.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. D. S. Anderson; A/C.2 S. Booth; P/O. D. W. Brown; Sgt. J. Cooper; Sgt. W. Durey; Flt. Lt. C. W. Francis; Sgt. H. H. Harrington; L.A/C. J. L. Moulder; Sgt. D. Playfoot; A/C.2 J. G. Robinson; L.A/C. B. K. Wood.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Cpl. H. Brown; A/C.2 D. A. Smoothy.

DIED ON ACTIVE SERVICE.—A/C.2 R. I. R. Aird; L.A/C. L. H. Bourne; A/C.1 T. E. Brett; Flt. Sgt. C. Colman; L.A/C. J. Curtis; Act. Sqn. Ldr. P. F. Davies; L.A/C. G. N. Dobson; L.A/C. D. Docherty; Sgt. M. L. Guiver; A/C.1 E. W. Hawkins; A/C.1 J. Luscombe; A/C.2 J. R. Pennick; A/C.1 M. L. Preston; Cpl. T. Russell; A/C.2 F. Tagney; L.A/C. W. A. Thompson; Cpl. H. B. Telson; A/C.1 A. F. Ware; L.A/C. J. C. Wood.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—A/C.2 V. J. Allen; A/C.1 T. L. Beaven; Act. Flt. Lt. C. C. Cheshire; Sgt. S. Dawson; F/O. S. H. Dowse; Sgt. E. C. Gurmin; P/O. F. G. Horner; Sgt. P. H. T. Horrox; A/C.1 J. W. F. Liddle; Cpl. L. Lyne; A/C.1 F. Miller; P/O. W. E. Mehill; Sgt. W. W. Oakley; A/C.1 R. E. Rogers; Sgt. G. J. Smalley; P/O. J. A. Timmis; L.A/C. J. T. Walker; Sgt. R. C. Wash; Sgt. E. N. Webb; Sgt. H. Wheelan.

Amendment to Communique No. 83.

L.A/C. H. Blundred is now reported killed on active service.

MORE RETRIBUTION: Armourers preparing a 1,000 lb. bomb for stowage in a Stirling. The cable comes from a hoisting winch in the fuselage. (*Flight* photograph.)

Royal Australian Air Force

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. S. Denby.

MISSING.—Sgt. H. L. B. Morphett.

KILLED ON ACTIVE SERVICE.—P/O. G. L. Cohen; P/O. W. H. Crane.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. S. E. Wilton.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. W. H. Blades; Sgt. W. Stuart.

WOUNDED OR INJURED IN ACTION.—P/O. G. A. Casey.

MISSING.—P/O. H. J. Cook; Sgt. J. Glover; Sgt. A. L. Halsey; Sgt. L. A. Stock.

KILLED ON ACTIVE SERVICE.—Sgt. W. E. Dale; P/O. W. R. Hughes; Sgt. J. A. Parker; Sgt. H. R. Teskey.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. Varley.

Royal New Zealand Air Force

KILLED IN ACTION.—P/O. R. S. Austin.

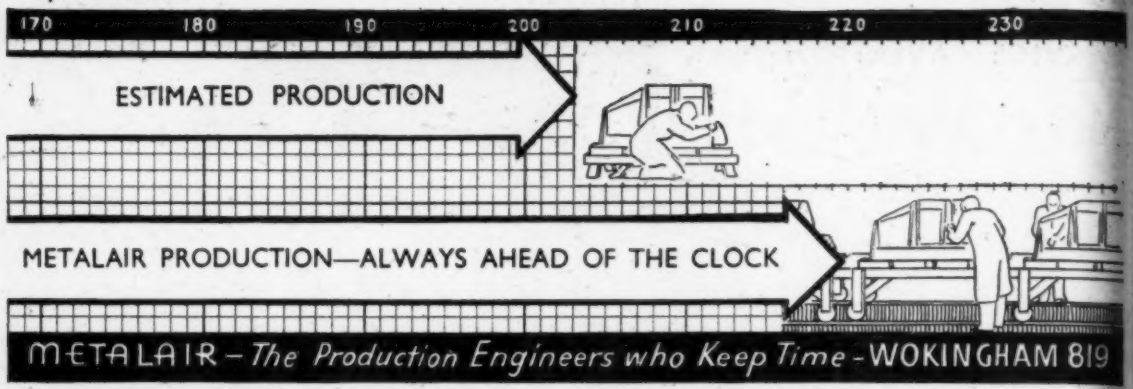
WOUNDED OR INJURED IN ACTION.—Sgt. P. E. Weight.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. A. J. Black; Sgt. H. R. W. Watkins.

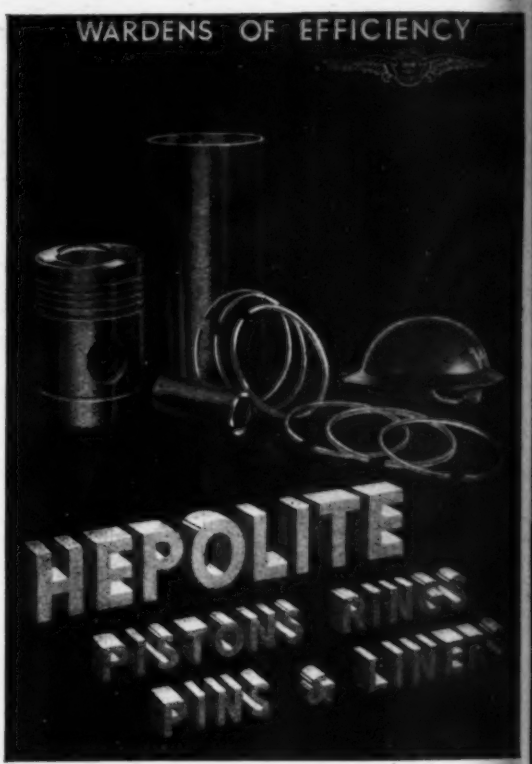
South African Air Force

PREVIOUSLY REPORTED DIED ON ACTIVE SERVICE, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Lt. P. D. Aneck Hahn.

TO SHOW YOUNGSTERS THE WAY: A.T.C. officers charting a course at sea during practical navigational training.


170
180
190
200
210
220
230
ESTIMATED PRODUCTION
METALAIR PRODUCTION—ALWAYS AHEAD OF THE CLOCK
METALAIR – The Production Engineers who Keep Time – WOKINGHAM 819

At the 'Ready!
Its portability and immediate readiness for service make the J.B.P. Oil Dispenser an outstanding re-fuelling unit. Various sizes are made with capacities from 30 to 100 gallons. The rotary pump, which is easily operated by hand, will deliver oil at 3 gallons a minute up to 30ft. high. A special anti-drip valve is fitted to the discharge nozzle. Thermostatic heaters can be fitted for dispensing warm oil.
JOHN B. PILLIN LTD.
Oil Unit Dept.
BECKENHAM.


WARDENS OF EFFICIENCY
HEPOLITE
PISTONS RINGS
PINS & LINERS

Everything in
SHEET METAL
is better by the
Approved by
AIR MINISTRY
WAR OFFICE
ADMIRALTY
CITY SHEET METAL WORKS LTD.
Telephone: BLACKBIRD RD. LEICESTER Leicester 65107

INTERCHANGEABLE STEEL TYPE
AND HOLDERS
MEERLOO LONDON
ON AIR MINISTRY APPROVED LIST Nº B41693/39
LARGE PRODUCTION & GOOD DELIVERIES
JOHN MEERLOO & SONS
74, LONDON Rd KINGSTON-ON-THAMES

, 1941

819